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GOD AND CREATION

THREE

INTERPRETATIONS OF THE UNIVERSE

JOHN ELOF BOODIN

PROFESSOR OF PHILOSOPHY

UNIVERSITY OF CALIFORNIA AT LOS ANGELES



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To One of the Sanest
and Most Constructive Representatives
of Contemporary Thought

PROFESSOR A. LALANDE

FOREWORD

The volume, *Three Interpretations of the Universe,* takes up three conceptions of history: Preformation, Emergence and Creation, and discusses them in terms of some of their leading exponents in the fields of philosophy and science. Such a survey must necessarily be selective. In science the author has emphasized those trends which seemed to him important for cosmological interpretation, and in philosophy he has chosen his illustrations for the most part from the great classical philosophers, especially the Greek who seem to offer the most fruitful approach to our problems to-day. The interpretations of philosophers are the result of the author's own research rather than the examination of commentaries. To give the reader an opportunity to exercise his own judgment, extensive quotations and citations* have been given. The volume ends with a brief sketch of the author's point of view. Since the author believes that philosophic interpretation must grow out of the enterprise of history and must also revise the previous hypotheses in the light of present evidence, he could not shirk either the task of examining significant efforts in the past or of taking stock of the present situation. In philosophy as in other human endeavors, we can only hope to be mediators between the past and the future. There can be no finality in human efforts.

"With welcome toil," the author has gathered jewels of wisdom from caskets, old and new. They are pearls of great price. They become alive when they feel the living touch of thought and glow with a lustre, partly their own, partly that of the genius that lovingly handles them. The author has tried to set them in their own historic patterns and also to translate them into the language and pattern of our own creative life. History, Hegel tells us, must be re-written in every generation and it is only when we recreate the wisdom of the past in our own living

* The notes have been separated into two classes. Those that are an explanation of the text are put at the bottom of the page, while those that are citations are put at the end of the chapter.

experience that we can appreciate its significance. But whatever may be our success or failure in re-interpreting the great thoughts of the past, they will shine with their own light and will invite other minds to discover the suitable setting. They are the precious heritage of history, the concentrated genius and labor of the ages. They should not be neglected and left to gather dust in the antiquarian shops of mediocrity. They should shine in the life of creative minds. Being the children of genius they wait for the touch of genius. The author invites the reader to share these jewels with him, for their value increases with sharing. He believes that historical orientation is especially called for at the present time, which is prone to follow the will-o'-the-wisps of spurious novelty.

If the reader finds the lead, suggested in this volume, promising, he may be interested to examine the author's personal synthesis in the companion volume, *God.* While the volume, *Three Interpretations of the Universe,* is more particularly addressed to students of philosophy, and the companion volume, *God,* to all who have an imaginative and religious interest in the life of man in the universe, the author believes that the style of the former is not too technical for the latter group and that the former group may contain those who have a poetic as well as an academic interest in philosophy. Poetic interpretation needs to be grounded in history and science; and philosophic scholarship is barren unless it leads to poetic interpretation. The author believes that the time has come for philosophers to leave their verbal game of technical quibbles and to concentrate on the great issue: man's place in the universe. Only by doing this does philosophy to-day deserve to share the name of philosophy with the great Greek masters.

The author's development in philosophy started with radical empiricism and temporal realism as a protest against the static conception of reality as maintained at the end of the nineteenth century by both the mechanists and the absolute idealists. His early philosophy emphasized absolute flux and temporal novelty. In the terminology, which has recently become fashionable, it was a philosophy of emergence. This was expressed in his doc-

tor's thesis, *A Theory of Time,** 1899, and in his monograph, *Time and Reality,* 1904. But he was obliged on further thought to recognize the pragmatic reality of the world of ideal values, and this recognition found expression in various essays culminating in the last chapter of *Truth and Reality,* 1911. His further analysis convinced him of the reality of form or structure in the kaleidoscopic world in space and time, and this point of view was set forth in *A Realistic Universe,* 1916, (revised edition, 1931). This recognition led, in *Cosmic Evolution,* 1925, to the cosmological hypothesis of a spiritual control which gives measure and order to the process of nature. This cosmology has, in the volume, *God,* developed into a theology—an effort to show the significance of God in the universe. It will be seen that the author's development is closely analogous to that of Plato who started as a Heraclitean and was forced by his logic into idealism. But the author's own discovery of Plato came only at the end of the quest.

The author wishes to express his acknowledgment to *Mind* for the use of the article, "Cosmology in Plato's Thought," October, 1929 and January, 1930, which now has the title, "Artistic Creation in Plato." This essay has been revised and enlarged in this book. The author wishes finally to express his indebtedness to his friends, Mr. Norman Hinton for his aid with the Index, Professor F. C. S. Schiller for reading a large part of the MS., and his Colleagues in the department of philosophy at the University of California at Los Angeles for their encouragement and appreciation of his efforts.

* The doctor's thesis, *A Theory of Time,* 1899, has not been published but is available through the libraries of Harvard University, the University of California at Los Angeles and in the British Museum. *Time and Reality,* 1904, was published as number 26 in the Psychological Review Monograph Series. *Truth and Reality,* 1911; *A Realistic Universe,* 1916, revised edition 1931; and *Cosmic Evolution,* 1925, were published by the Macmillan Company.

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PART I

PREFORMATION

Chapter 1

PREFORMATION IN ANCIENT AND MEDIAEVAL THOUGHT

All reality is history and all history is a process of evolution. If, then, we take evolution as the historical process by which the present order of nature has been established, we can distinguish three types of interpretation, viz., Preformation, Emergence and Creation. By preformation I mean the notion that evolutionary development is latent in the process so that the later forms and stages are really an unfolding or making explicit what is already present in the earlier stages of the same history. This is the old and original meaning of the word evolution as contrasted with epigenesis: the latter implies an intrusion of novelty into the process. By emergence I mean the appearance of new characteristics and structures in the process with no apparent guidance from within or from without. Lastly, by creation I mean the occurrence of new forms, characters and stages under the guidance of an actuality which controls and animates the course of history. According to this view the later stages are not preexistent, but are due to an impetus from outside the particular history. They presuppose the interaction of the particular history with an actuality which foreshadows the future stages of the evolutionary process either existentially, or eminently (i.e., as capable of producing them because it implies them and more besides). Thus creation is epigenesis or emergence (in recent terminology) together with control from a higher level. Historically these interpretations often overlap and it is not easy to find pure types. But we shall use illustrations in which one or the other type dominates.

The impulse to the preformist view in Western thought comes no doubt from Plato and Aristotle,* who emphasized the pre-

* It has been suggested that Parmenides is the real father of preformation. But the distinction of form and process did not exist for him, and therefore Parmenides cannot be said to deal with our problem.

eminence of form over matter. The world of form is dignified with the name "being" or "substance," while the world of process is relegated to an inferior place. At any rate form legislates or should legislate to process. In this sense there is preformation in the world of Plato and Aristotle. But according to our definition neither Plato nor Aristotle can be regarded as a strict preformationist for both recognize processes with emergent qualities as well as a guiding form. I shall, therefore, deal with them under creation. This classification will seem less obvious in the case of Aristotle than in the case of Plato. Aristotle certainly tries to emphasize the immanence of form as against what he regards its transcendency in Plato, and it would be easy to quote passages from Aristotle in support of immanent preformation. Aristotle finds the language of immanence particularly congenial to his biological bias. "Nature produces those things which, being continuously moved by a certain principle contained in themselves, arrive at a certain end." "Nature does nothing without an aim." "She is always striving after the most beautiful that is possible." Aristotle's conception of nature is essentially animistic. When Aristotle deals with the problem of genesis from the cosmological point of view, the whole striving for form in nature and man is conceived as a hierarchy culminating in a transcendent God who inspires the whole cosmos with love for form, the perfect Divine. Aristotle, however, is not an evolutionist in the modern sense, since he believes that species and the cosmic order are eternal. Evolution in Aristotle, therefore, can have reference only to individual development. It is in embryology that Aristotle is an evolutionist in the modern sense. Here he holds the theory of epigenesis, but with the implication of a guiding form. I have dealt with him, therefore, under creation, though his immediate influence, as shown in Stoicism, tended towards preformationism.

Stoicism and Preformation

Stoicism has received a somewhat stepmotherly treatment from historians of philosophy. This is due in part to the one-sided interest of modern historians. If we have regard to the

social effects of philosophy, no system of philosophy has affected human civilization more profoundly than has Stoicism.[1] The Academy and the Lyceum lost their vitality after the death of their founders. The characteristic doctrines of the founders were lost sight of. The Academy became the centre, first of formalism, then of scepticism; and the Lyceum, abandoning the theology of Aristotle, reverted to naturalism. The idealism of Plato and Aristotle was as uncongenial to the Greek mind as was the mechanistic conception of Epicurus. The former continued in Alexandrian Neoplatonism (in which Semitic influence is evident), and furnished the framework of Christian theology. Stoicism was the constructive influence in the Greco-Roman world from the generation after Aristotle up to the time when the Catholic church came into dominance; and the Catholic church absorbed a great deal of the spirit of Stoicism. The sceptics of the Academy directed their criticism chiefly against Stoicism, just because it furnished the only definite positive background. The greatest of them all, Carneades, is quoted as saying: "But for Chrysippus where should I have been?" It was the Stoics who tried to furnish a constructive philosophy by which the ancient world could make the transition from the old mores to new mores, in the intellectual and moral world alike.

It was under Stoic influence that Roman jurisprudence was emancipated from its local customs and universalized into a system which in its broad human basis transcended nationality and geography until it embraced Roman and non-Roman, man and woman, adult and child, freeman and slave. The Stoics created the concept of "common law"; and their interpretation, if not invention, of "natural law" and "natural right" gave the impetus to the progress in jurisprudence and to the widened conceptions of human relations of which we are the heirs. If they could not abolish slavery, they tried to show that slavery is a violation of "the laws of nature," which led to large-scale voluntary emancipation. It was in the spirit of Stoicism that the Roman jurist, Ulpian, laid down the proposition: "All men, according to natural right, are free and equal." The Ro-

man experiment was brought to a close by the conflict of races, but its influence became the basis of a new social order and still lives. It was upon the Stoic background of universal law and universal order that Christianity built a universal church. It was no accident that St. Paul, when he wanted to argue before an Athenian audience for a universal God, the father of us all, "in whom we live and move and have our being," used the language of the Stoic poet, Aratus.

We think of the Stoics as primarily moral teachers, and that is true. But the Stoics did not separate the moral life from its larger setting. To be moral meant with them, not merely to have the right attitude to one's fellowmen, but also the right attitude to the universe—to live in accordance with cosmic reason. Stoicism is sometimes thought of as a retrograde movement, because it went back to Heraclitus for its philosophic starting point. But Heraclitus is probably the greatest metaphysical genius of the ancient world; and, in going back to the pre-Socratics, the Stoics carried with them a great deal of the fruits of the philosophy of Socrates, Plato and Aristotle. Socrates always personified the Stoic sage. And while abandoning the transcendency of the forms of Plato, the Stoics gave them a new meaning as germinal reasons or *logoi,* immanent in the cosmic process. In returning to the cosmic immanence of the earlier naturalism, they were true to Greek genius. The school founded by Aristotle did the same. Strato of Lampsacus, the successor to Theophrastus in the Lyceum, "saw no need for an external supernatural cause and renounced the idea of God as a being separate and distinct from the world as a whole." Nature was self-sufficient for him, and "for him, as for Aristotle, nature is impersonal, a necessary force, operating without consciousness and reflection."[2] The Stoics tried to reconcile, in their conception of cosmic immanence, the claims of idealism and naturalism. They carried to its logical conclusion the theory of Aristotle (which he failed to carry out), viz., that form is immanent in matter. Plato himself had abandoned the transcendent ideas in the *Laws;* and the cosmic soul which transfuses everything became the source of motion and of order. For both Plato and Aristotle

the universe is an organism. The Stoics adopted this conception, shorn of any transcendent elements. The cosmic macrocosm is conceived on the analogy of the human microcosm. As the human soul transfuses the human body, animates and controls it, so God, the cosmic soul, transfuses, animates and controls the cosmic body; or rather the Cosmos is a body with a pervasive, controlling soul. The soul is not something immaterial, apart from body, but "intellectual fire" (to use Gilbert Murray's expression) which pervades the whole even as it pervades the human organism.

The classical Stoics are perhaps the most thorough-going preformationists. They are the only preformationists who take time seriously. They conceive the universe as *one* temporal process, proceeding from cycle to cycle, of which each cycle repeats in the minutest details the preceding ones. Following Heraclitus, they conceive the ultimate substance as fire.* This fire is matter but it is also spirit. It is soul, reason, God. They adopt the physics of Heraclitus with its upward and downward path, with the addition of air which had been discovered by Empedocles. Fire is transformed into air, air into water and water into earth, and reversely, according to a law of compensation. The four elements in their genetic hierarchical order constitute, through their mixtures, the physical world.

For the Stoics, form is dynamic and legislative. The forms are "seeds." Individuals are dominated by individual *logoi* or seminal reasons, formative patterns. But the cosmos is dominated by universal Reason, the *Logos* of the whole. When the world cycle comes to a close everything is absorbed into the cosmic fire—the *logoi* as well as the matter. In this state there is the maximum of tension and the maximum of tenuosity. With the cooling process the tension decreases and the density increases. Fire cools down into air and the air into moisture. From this

* According to R. D. Hicks, the Stoic fire or soul is not the fire of Heraclitus. Their ultimate element is rather *pneuma*, fiery breath, an element intermediate between air and fire. It exists as the pure ether of the outer regions, but it also pervades everything as tension in varying degrees. Zeus is the ultimate *pneuma*. See article, "Stoics," *Encyc. Brit.*, 11th ed. But Hicks' distinction is probably too precise.

moisture are born the four elements. The seminal reasons which are potential in the universal moisture assert themselves and history begins anew. The formative patterns shape a new world with its variety and gradations.

The Stoics attempt to express everything in naturalistic terms. Everything is body and body is essentially extended. The cosmos is conceived as an individual body. This body is a plenum. There is empty space outside the spherical cosmos, but there is no empty space within the cosmos. What appears to us as emptiness is in reality filled with air and fire. The cosmos begins and ends as fire-stuff; the bodies we perceive—the earth, the sun, the stars—are condensations of the cosmic fire to be rarefied into fire again. Anaximenes' principle of condensation and rarefaction accounts for cosmic evolution. But the Stoics were able to unify the whole process by the principle of tension. This principle is already suggested by Heraclitus, for harmony is the result of tension as in the bow and the lyre. For Zeno, the founder of Stoicism, sleep is a relaxation of tension. But it was Cleanthes, Zeno's successor, who raised the principle of tension to cosmic importance. He explains the difference in the elements as a difference in tension. Fire has the greatest tension. Air is closely akin to fire. Water has less tension and earth has the least. But there is nothing without some tension. Thus the concept of tension enables the Stoics to interpret body monistically, in spite of the apparent differences.

But what is "tension"? It is associated with "spirit" *(pneuma)*, a term invented by Cleanthes. "This term appears to have been first intended to combine the conceptions of the creative fire and the *Logos* but it gradually came to have distinctive associations of its own. Like fire, 'spirit' is to the Stoics a substance, stuff, or body akin to the element of air, but associated with warmth and elasticity; it is conceived as immanent in the universe and penetrating it as the deity; immanent in the human body and penetrating it as the soul. The elasticity of spirit is measured by its 'tension' *(tonos, intentio)* by means of which its creative power pushes forward from the centre to the circumference: as for instance in the human body walking is

effected by 'spirit exercising tension towards the feet.' The theory of tension has an immediate application to ethics. When the soul has sufficient 'tension' to perform its proper work, it operates according to the virtues of Wisdom, Justice, Courage, and Soberness; but when the tension is relaxed, the soul becomes disordered and is seized upon by the emotions.''[8] Tension evidently has to do with the health of the organism, whether conceived as microcosm or macrocosm. It distinguishes the living from the dead. But for the Stoics there is nothing that is absolutely dead or inert. There is a principle of continuity in nature. The universe is a living whole, and the parts, even the apparently dead parts, have some degree of soul. Fire and air manifest soul par excellence. But water cannot be devoid of soul for it nourishes living things; and even the stone has coherence and therefore must be ''compact with air.'' The divinity of the whole penetrates even the stone. Soul is not an abstract form but a current which runs through the whole body.

Were the Stoics monists? They have sometimes been called materialists since they insist that reality is body and extended body. Everything real is corporeal. Individuals are corporeal, qualities are corporeal, God is corporeal. They came to the conclusion that everything is corporeal, because the only cause of motion which they recognize is by contact. This idea came to them from common sense. But it was also part of the philosophic tradition. Even Aristotle's God moves the outermost sphere by ''contact.'' They could not, any more than we can, conceive action at a distance. But body was not to them, as to the atomists, an inert thing with merely external relations. Body is essentially active, animated, ensouled. It is permeated with *pneuma*. Action is by interpenetration, interfusion. Their favorite metaphor is that of wine and water. The wine is interfused with the water throughout the volume. (They did not think of the mixture as a chemical process.) Thus soul is interfused through the human body, and God is interfused through the Cosmos. But soul is corporeal and there is nothing without some degree of soul. Matter without soul, while still extended, would be shapeless and chaotic.

Since the Stoics hold that fire is the ultimate element and identify fire with soul and reason, they have sometimes been called panpsychists. It has been said that their ultimate element might be characterized as mind-stuff. But the Stoics do not distinguish psychical stuff from physical stuff in their description of reality. When they feel forced to do so, as in distinguishing concepts, statements and subjective meanings from process, they regard the former as unreal. Perception, imagination and judgment as operations are real. They are operations of the body. Virtues are dispositions and operations of the body and therefore real. Qualities are operations of things and they are impressed upon the perceiving body just as they are. Hence we can know reality as it is. The Stoics were naïve realists. They had of course the problem of illusions and hallucinations. But they tried to get around the difficulty by holding (as Kant later did) that real things produced a peculiar conviction which gave assurance of reality. When Carneades showed that false perceptions might produce as much conviction as true, they were obliged to modify their position in the direction of probability. One thing is certain and that is that the stuff of the Stoics is not psychical stuff and that they did not regard the corporeal world as the appearance of mind-stuff. The corporeal world, endowed with soul, is the real world.

Pragmatically, we may say that the Stoics were pluralists or dualists. The four elements have reality in the world as it is. They are identified with the four qualities, hot and cold, and dry and wet, of which all things consist. But the four elements reduce practically to two. Fire and air are pragmatically alike. The word for spirit, *pneuma,* is borrowed from air. It means breath. Air is supposed to be warm because the breath is warm. The two elements, fire and air, constitute the active factor in nature, while water and earth constitute the passive factor. Passivity means inertia. They took over the dualism of the active and the passive from Aristotle. But the dualism is relative with the Stoics. The dualism is relative pragmatically because there is nothing that is absolutely passive. Everything is more or less active. The dualism is relative genetically because every-

thing is derived from fire and returns to fire, and fire is the active principle, the efficient cause—the only real cause for the Stoics. They identify the formal cause and the efficient cause and eliminate the other two causes of Aristotle—the material and the final. The transformations of fire into air, water and earth seems to be a physical, not a chemical, transformation. It is a difference in tension. All the while the fire-soul is the pervasive, constructive or "artistic" principle in nature, but is distinguished from common domestic fire which is destructive.

Instead of trying to translate the stuff of the Stoics into the later philosophic abstractions of material and psychical, we should come nearer the truth if we translated it into the modern scientific language of force or energy (in the loose sense of doing work); and we might speak of the difference in elements as a difference in potential. In this sense we might speak of the Stoics as dynamic monists. There is for the Stoics a soul-potential or life-potential, the disappearance of which from a body makes it seemingly dead, though there is nothing absolutely dead. Translating their term, body, into terms of energy, we might say that everything real is organizations of energy and operations of energy. It then becomes no longer paradoxical to say that qualities, virtues and souls are bodies. They are known as energies. What does not act or is not capable of acting is not being. They follow the lead of Parmenides and Leucippus in limiting being to the corporeal, but the corporeal is not contrasted with the psychical. It includes it. In one respect the Stoics (following the lead of Heraclitus) had the advantage of modern science: they postulated an upward path as well as a downward path. There is a rhythm of degradation of energy-potential and of rise of energy-potential. Thus there is restitution. The lower elements which arise from the higher, in turn feed the higher and eventually are consumed or absorbed into the cosmic fire, when the cosmic soul becomes "too big for its body."

While the Stoics maintained that everything that has being is corporeal, they felt obliged to admit that other things *exist* beside body. They were obliged to admit space. There is no

empty space in the Cosmos, but the Cosmos is finite. The elements in the present state of affairs are arranged in concentric layers. The heavy elements are those that tend to the centre, earth being the heaviest and next to it water. The elements that tend to the circumference are the light elements, viz., air and fire. The two sets of tendencies balance. Hence the Cosmos has no weight. This arrangement produces the spherical shape of the Cosmos. The Stoics regarded it as impious to speak of other worlds, in the manner of the Atomists. They also helped to make orthodox the geocentric Aristotelian astronomy as opposed to the heliocentric. Cleanthes said that Aristarchos of Samos should have been prosecuted for impiety, "for disturbing the hearth of the Universe." But if the Cosmos is finite, empty space must stretch infinitely outside the universe. The volume of the universe increases with the fiery state and decreases with the condensation of fire into stars and other bodies, and therefore the extent of space, which the universe occupies, varies. Since empty space exists, the Stoics felt obliged to distinguish the All, which includes both the Cosmos and empty space, from the Cosmos which is finite and a plenum. Time exists only in bodily motion and hence time as an abstraction would belong to the existent but non-corporeal. We have seen that psychological abstractions, though existent, are non-corporeal and therefore non-being. Non-entity for the Stoics means non-corporeal. The statement, then, that the Stoics may be regarded as dynamic monists must be qualified by their admission of non-dynamic existents such as empty space.

But even on dynamic grounds, the conception of Stoicism as monism is open to objection. They postulate, it is true, one comprehensive fire, the *Logos* or world soul, which they call Zeus or Jupiter. But they postulate also particular *logoi,* germinal reasons or creative patterns. These to be sure are all absorbed into the cosmic fire as one flame absorbs another. But they may be said to be potentially present in the conflagration; and they germinate again when the reverse process sets in and fire cools down to moisture. The later Stoics used the language of creation and spoke of Zeus as creating the elements and the world out of

chaos by planning. But this was in deference to popular imagination and shows other influences. The classical Stoics spoke the language of cosmic immanence. As one cosmic cycle is conceived as repeating previous cycles in the smallest detail there must be cosmic memory. Some of the Stoics certainly regarded "the original fire as itself containing the seeds or *logoi* of all things that are to be created."* The same idea seems to have been in the mind of Seneca when he speaks of Zeus, in the state of the general conflagration, as being "alone with his thoughts." What disappears are the grosser elements which the Stoics think of as matter in a special sense—viz., earth and water. Everything returns to soul or "spirit" in the fire-state (though it should be noted that this does not cease to have the physical properties of extension, enormous tension and temperature). Chrysippus tells us that "the universe is then its own soul and its own controlling mind." Zeus, it is said, falls back upon Providence, i.e., there is no longer the distinction of cosmic body and cosmic soul, there is only cosmic soul, the cosmic field, with its finite spherical volume. There is of course no concrete or functional immortality for the Stoics. The individual is absorbed in the cosmic fire. Even the gods of popular mythology are reabsorbed, and the stars like moths dart themselves into the flame of the sun. But there is at any rate potential immortality, if the seeds, the germinal *logoi,* are taken up into the universal *Logos,* to become incarnate when the conditions permit. The whole process is one of necessity when viewed from the causal point of view. But when viewed from the point of view of the whole—the cosmic Reason, *Logos* or Word—the process is one of immanent and free expression.

The idea of cycles is fundamental with the founders of Stoicism. It was ignored in the later development of Greek Stoicism, but it was revived with enthusiasm by the Romans. To the Roman poets, Virgil and Ovid, it meant the return of the golden

* E. V. Arnold, op. cit., p. 95. See the citations. The Stoics are not always explicit on this point, and so made possible the interpretation of materialistic emergence, as in Plotinus' treatment of Stoicism. There must have been a right wing and a left wing.

age which for them was in the remote past. Seneca elaborates the theme, but strangely enough combines it with the idea of universal progress. It is evident, however, that if one cycle is an absolute repetition of the past, there can be no real progress. The golden age must be followed by the degenerate ages, even as in the present cycle. This Seneca does not seem to realize. But the English poet, Shelley, recoiled at the implication. He too was enamoured with the prospect of the return of a glorious past:

The world's great age begins anew,
  The golden years return,
The earth doth like a snake renew
  Her winter weeds outworn:

A brighter Hellas rears its mountains
  From waves serener far;
A new Peneus rolls his fountains
  Against the morning star.

Where fairer Temples bloom, there sleep
Young Cyclads on a sunnier deep. . . .

Another Athens shall arise,
  And to remoter time
Bequeath, like sunset to the skies,
  The splendour of its prime;

And leave, if nought so bright may live,
All earth can take or Heaven can give. . . .

The poet's fancy delights in the prospect of the return of these and other beauties that have past, but the ghost appears at the banquet. In restitution we must accept the return of evil with the good.

Oh, cease! must hate and death return?
  Cease! must men kill and die?
Cease! drain not to its dregs the urn
  Of bitter prophecy.
The world is weary of the past,
Oh, might it die or rest at last.[4]

More recently Friedrich Nietzsche has revived the idea of repetition. But Nietzsche, like Lucretius, bases the idea of repetition upon the probability of chance, not upon cosmic pattern: "If the world may be conceived as a definite magnitude of force, and a definite number of force-centres—every other

conception of it is wanting in definiteness, and therefore useless—it follows that it has to go through a calculable number of combinations in the great game of chance of its existence. In the eternity of time every possible combination would, at some time or other, have been reached. More, it would be reached an infinite number of times. And since between each combination and its next return every possible combination will have occurred, and since each of these combinations determines the entire sequence of combinations in that series, we must assume a cycle *(Kreislauf)* of absolutely identical series; the world is a cycle which has already repeated itself an infinite number of times and plays its game *ad infinitum.*'"[5] Science does not indicate that the universe is such a game of chance as Nietzsche postulates. Moreover, entropy prevents a material universe from going on *ad infinitum.* Cosmic histories are finite histories, and I shall try to show that they have pattern (Gestalt). The Stoic conception, with all its crudities, is, I think, nearer to the spirit of present science than Nietzsche. But cosmic equilibration of the type contemplated by the Stoics cannot, I think, be conceived if we postulate just one cosmic history, as the Stoics do. There must be the interaction of histories at various levels of potential. The Stoics have failed to furnish a rationale for the upward path, but so has science up to the present time. Moreover, if we introduce the factor of individual will or "assent," as the Stoics certainly do when they deal with the moral problem, the repetition cannot be absolute.

Are the Stoics fatalists? There can be no doubt that the Stoics postulate the universality of causality. When they regard the universe from the point of view of causality every event is determined. Hence the theory of absolute repetition from one cycle to another. But the Stoics also regard the universe from the point of view of *Logos,* purpose, rational control. Since the human soul is of the same essence as the cosmic soul, it too acts purposively, teleologically. As rational, the soul is self-determining. The postulate of individuality is as fundamental as that of universal law. "The Stoics were the first to grasp the principle of individuality *(principium individua-*

tionis)."[6] No two particular things are exactly alike. Every leaf, every hair, as well as every plant, animal and man is different. "Each and every existent particular is absolutely unique. But a full description will always specify that it is (1) a thing, (2) of a certain quality, (3) modified in a certain way, (4) in a certain relation to something else."[7] The Stoics were not realists in the mediaeval sense. Only individual things are real. Concepts are abstractions and are not real.

It is of course their moral interest which leads them to emphasize individuality. The human individual is free to give or withhold his "assent," whether in cognitive judgment or in moral choice. "Everything is determined by natural necessity but in the moment of judging the rational being is free to obey reason or disobey it."[8] The Stoics were the first to emphasize the unity of the soul and its activity, though at first they denied the non-rational element in the soul. Freedom for the Stoics, moreover, was not limited to mere assent or refusal. The Stoics recognized the constructive or artistic activity of the soul. Man can re-create institutions; and the Stoics played no small part in this re-construction. Further, destiny is what we make it. What matters is not so much the game as how we play the game. The world is good or bad, so far as we are concerned, according to our attitude. If we are true to ourselves, nothing can really hurt us. And the Stoics believed in playing the game courageously and cheerfully. They created an elaborate Theodicy to show how Zeus "can make the crooked straight." But the important thing is that, so far as *we* are concerned, *we* can make the crooked straight. God himself cannot interfere with how we play the game, though he may overrule our mistakes in the whole. For different purposes then the Stoics held to the postulates of universality and individuality, necessity and freedom. So do we.

Are the Stoics pantheists? Again we find that the Stoics use different postulates for different purposes. God is certainly pervasive force. He penetrates even the stone as coherence. He is present throughout the whole extent of the cosmos, as our soul is present throughout the extent of our body. The whole cosmos

is instinct with life, as our body is instinct with life. But God is not present in the same way everywhere, any more than the human soul is present in the same way throughout its body. The human soul is not present as reason in the hair, nails, and bones, but only as the principle of coherence and growth. Pragmatically speaking, i.e., taking the universe as it is, God is the highest level, the spiritual fire or ether, which is present undivided and everywhere. The lower levels are not God, though God pervades them. In the universal conflagration everything exists in God in abeyance, as it were. But it is with the present world that we are actually concerned; and here everything is not divine in the sense that it is God, though everything owes something to the cosmic soul in which we live and move. Men have souls which at their best are of the quality of God. Animals have lower souls, without reason. Plants do not properly have souls but in them nature, *Phusis,* operates as the principle of growth. Inorganic things owe their coherence to the cosmic soul. But the divine soul is not identical with human or animal souls or with plants and inorganic things. It is infinitely more, though it is the soul of many a soul. It is the creative or artistic principle which is present in everything. God is omnipotent in the sense that, in his own being, he is limited by nothing. But he is not unlimited in the sense that he does everything. Cleanthes in his great hymn to Zeus addresses God as the omnipotent, king of kings, whose universal Word *(Logos)* pulsates through all.

> Whose purpose brings
> To birth, whate'er on land or in the sea
> Is wrought, or in high heaven's immensity

but he is quick to add

> Save what the sinner works infatuate.

For such works Zeus can create compensation:

> Nay, but thou knowest to make crooked straight;
> Chaos to thee is order.

But he cannot prevent them.

But must not a divinity which pervades the whole cosmos, which indeed, in the constructive sense, is the cosmos immanent

in every part; which is the *Logos,* the creative soul of the universe, seem impersonal and indifferent to our human struggle? This is a problem which is not peculiar to Stoicism. It is a difficulty which must always be felt in connection with a God of cosmic proportions. The Stoics felt the presence of God as a personal and intimate presence, "a Friend behind phenomena," to use Edwyn Bevan's characterization;[9] and so have devout worshipers of all the great religions. Gilbert Murray thinks this feeling of cosmic companionship may be a survival of the spell of the gregarious instinct, the craving for the lost pack: "It may be, it may very possibly be, that in the matter of this friend behind phenomena, our own yearning and our almost ineradicable instinctive conviction, since they are certainly not founded on either reason or observation, are in origin the groping of a lone-souled gregarious animal to find its herd or herd-leader in the great spaces between the stars."[10] But man craves more than animal companionship. He craves companionship in the creative life. He craves that the highest activities, to which animals are strangers, shall not be isolated from the universe but be somehow akin to Something in the cosmos; and he feels that this Something, little as he can fathom It, must somehow have a friendly interest in his ideal endeavors, stumbling though they be, and be ready and willing to reinforce his better nature, which does not derive from animal instinct. Such a postulate has been of an immense pragmatic value and is, I believe, reasonable even though it may not be capable of logical proof. What is?

That Stoicism had its effects on the Catholic theory of creation is evident from St. Augustine and Erigena. St. Augustine himself preferred to think of creation in the more dramatic manner of the six days though he interpreted these allegorically. But he refers in the twelfth book of the *Confessions* to other views which he acknowledges as within the Catholic tradition, because they held that God created the world in the beginning and out of nothing. One view holds that God really created the world at once and that the picturesque portrayal in the first chapter of *Genesis* is intended "for crude and carnal people,"

in other words it is a pedagogical device. "By the name of heaven and earth would he (Moses) first signify, universally and compendiously, all this visible world; so as afterwards by the enumeration of the several days to arrange in detail, and, as it were, piece by piece, all those things, which it pleased the Holy Ghost thus to enounce." Since according to this view the development in *Genesis* is educational and not in nature, we need not dwell on it. But this view is for St. Augustine associated with another view, according to which, though the creation is one act, it is potential creation, very much as the Stoics thought of it. "It yet remains for a man to say, if he will, that the already perfected and formed natures, visible and invisible, are not signified under the name of heaven and earth, but that the yet unformed commencement of things, the stuff apt to receive form and making, was called by these names, because therein were confusedly contained, not as yet distinguished by their qualities and forms, all those things which being now digested into order, are called Heaven and Earth, the one being spiritual, the other the corporeal creation." According to this view there is evolution in the older sense of unfoldment. What exists now is really present implicitly from the beginning. "Even so as in the grain itself there were invisible all things simultaneously which were in time to grow into the tree, so the world itself is to be thought of when God simultaneously created all things, as having at the same time in itself all things that were made in it and with it, when the day itself was created: not only the heaven with the sun and moon and stars, and so forth, but also those things which the water and earth produced potentially and causally: before that in due time, and after long delays, they grew up in such manner as they are now known to us in those works of God which he is working even to the present hour." St. Augustine, like Leibniz, was inclined to the view that all seeds are contained in the first seed, all men in the first man. Theological scruples prevented St. Augustine from working out an immanent view of creation. The only Catholic philosopher who had the courage to do so was Erigena.

Scotus Erigena and Preformation

Scotus Erigena comes nearest, among Catholic theologians, to being a strict preformationist. Erigena is a combination of rationalist and mystic and in the direct line of descent from the Neoplatonists through Pseudo-Dionysius whose works he translated from the Greek before he wrote his own great book, *On the Division of Nature.** The work is written as a dialogue in imitation of Plato's *Timaeus* which he quotes. He shows familiarity with Aristotle's *Categoriae* and *De Interpretatione,* with St. Augustine, Maximus, the Confessor, and Gregory of Nyssa, as well as Pseudo-Dionysius. While he is in the main a Neoplatonist, he is part of the Catholic tradition, and is obliged therefore to interpret creation monistically. There is nothing ultimate but God. God creates the world out of nothing. This means for Erigena that God concretes the world out of himself. Creation is really an unfoldment. This is the reason I regard Erigena as a performationist. Erigena differs from other Catholic philosophers in making creation an eternal process. The others regard creation as a fiat at a finite time. It had a beginning and will end. For Erigena, it is the eternal nature of God to be creative. He regards the Scriptures as the final authority. But reason, not the Church fathers, is the final authority as to the meaning of the Scriptures. By allegorical interpretation it becomes easy to square the Scriptures with reason.

For Erigena everything proceeds from God and returns to God. Creation is in a broad sense a theophany. God is the suprarational cause of creation, in the sense that he is the ground, substance, rationale of creation. Everything exists because it participates in God, but God is beyond distinctions, beyond essence, and therefore beyond definition. He is simple unity, but he is the unity of opposites. If we attempt to characterize God positively we must use the prefix super. He is super-essence,

* See also *Johannes Scotus Erigena,* Henry Bett, 1925 for a useful paraphrase and condensation of this work. The references are to Erigena's above work and also to Bett. The numbers in the text refer to Erigena's book. The translation is Bett's.

super-goodness, super-truth, super-eternity, for everything derives from him. He is more than essence for he is the source of all essence. We cannot characterize him as goodness because good is opposed to evil, and God is beyond good and evil: the darkness is light to him. Really to know God is to live God as only the redeemed can do. In that divine light everything is clear. But that light passes reason and definition. We distinguish between will and wisdom but these are not separate in God. For God (and for us) to know is to create. "So God makes all of nothing, that is, He produces of His super-existence, existence; of His super-life, life; of his super-intellect, intellect; and of the negation of all that is and is not, the affirmation of all that is and is not."[11] While God is beyond reason, he manifests himself as reason in creation.

As part of the Catholic tradition, Erigena conceives God as a trinity and the trinity is also revealed in creation. The trinity is a relation within God and at the same time a relation of God to the world. The trinity may be expressed as the Father, the *Ousia,* the ground; the Son, the Intellect, the Word; and the Holy Ghost, the spirit, the active force, the perfecting tendency in creation, which brings creation back to God. These suggest the Neoplatonic trinity—the One, Intellect and Soul—but for Erigena the members of the trinity do not exist in a hierarchy of descent but are co-ordinate expressions of the one God. In this he follows the Catholic tradition. We find both the unity and trinity indicated in the human soul which is one, though it functions as intellect, reason and sense. Intellect with Erigena, as with Neoplatonism, is the intuitive turning to the creative source. It is intuitive comprehension as opposed to discursive reason. What concerns us here is that in the divine Intellect or Word exist all the primal causes—the Platonic Ideas, the genera, the species, the individual forms. All the seeds are contained in the first seed. Erigena implies the extreme form of preformation which we find later expressed by Leibniz.

The easiest way to approach Erigena's conception of creation is to follow his fourfold division of Nature, as (a) creative

and not created; (b) created and creating; (c) created and not creating; (d) not creating and not created. The suggestion for this division came from St. Augustine's sentence: "The cause of things, therefore, which makes and is not made, is God; but all other causes both make and are made." The first and the fourth divisions of the process both refer to God. The first refers to God as the source or the ground of the process, the fourth refers to God as the goal of the process—the mystical culmination in which everything is reunited in God. This does not mean for Erigena the abrogation of individual qualities. "When what is lower is attracted and absorbed by what is higher, the lower does not cease to be, but subsists more worthily in the higher. The air does not lose its substance when it becomes radiant with the sunlight so that nothing can be seen but light; nor the iron when it becomes incandescent in the fire, so that nothing can be seen but fire. So the body does not lose its substance in becoming one with the soul, nor the soul in becoming one with God."[12] He thinks "the many may be one, without ceasing to be many. . . . Many lamps in a church give one light. Many friends make one harmony." But God as the source and the goal of all is one.

The second and the third divisions belong together as the created. Like Plotinus he conceives the universal as creative with reference to the sub-divisions below it, which in turn are conceived to be creative of those below, until the sensible individuals are reached—the last spray of the creative wave—where the creative process stops and the cycle turns on itself like the re-surging sea. But for Erigena God is immanent in creation. It is as though God differentiated Himself or created Himself in the descent of creation. In Whitehead's language, God concretes Himself. The Ideas are emanated first in the sense that they are logically prior to what follows. They are the primary causes of all things. They are eternal. They are not posterior to God in time. They are posterior in the sense that the consequent is posterior to the ground. (Erigena identifies cause and effect with ground and consequence.) The Ideas are not self-existent but are derived from God as the first principle

(ousia) in creation. It is through participation in the Ideas that all things are what they are. "Although properly speaking they exist among themselves as rays which emanate from a common centre, yet if we consider them in their generality in relation to creation, we may say that the Good comes first, then Essence, Reason, Intelligence, Wisdom, Virtue."[18] The pure intellect, whether of angels or of man in his blessed state, sees these Ideas, and the genera and species which follow from them, in the eternal Word—sees but does not define them, for this vision is beyond knowledge properly so-called. Discursive reason, which is the second grade of knowledge, deals with definition but it cannot see the Ideas, the first principles, in the Word. It can only contemplate them in their universality of action as this relates to what is below them. Yet reason sees them pure and without the intermediaries of sense. The third grade of knowledge, that of sense, has to do with the essences of particular things—the images of which are impressed upon our sense organs. Sense perception divides the essences into particular things, while the intellect and reason intuit them in their pure universality. Since man's nature includes intellect, reason and sense, man spans the whole scale of creation from the angelic to the lowest sensible. When the flow of creation, by its own gravity, has reached the lowest level, that of sense, the reverse process must perforce set in through the immanence of divinity in creation.

The descent of creation is by dual division, as in the Tree of Porphyry. The highest universal is goodness which emanates from divine Intelligence and is conceived as the creative cause of the procession. But Erigena does not identify goodness with God. Goodness is opposed to evil. God is beyond good and evil. Goodness is the source of essence or being. But goodness generates not only being but non-being. Non-being with Erigena is not a derogatory term as with the Neoplatonists. In non-being is included everything which is not grasped by the human mind as existent. It includes therefore, on the one hand, what cannot be grasped by the senses and the reason because it is higher and, on the other hand, that which is potential in the sense of

latent and which does not yet exist. Thus, for example, all the seeds of plants that shall ever exist are potentially in the seed of existing plants. Being again divides into the living and non-living, the living into the rational and non-rational, the rational into individual men. Man is the microcosm, the epitome of creation, for he participates not only in human essence but in the whole hierarchy of essences—vegetative, animal, rational. As intellect he shares the angelic nature. Everything participates in goodness since only goodness is creative. As an expression of the divine Intellect, man participates at any rate potentially in God. Through redemption this relation becomes actual on the human side.

In the ascent to unity the human soul rises by retracing the steps of creation from the lower to the higher. Ultimately all men and everything (including the devil who is also created by goodness) are destined to be restored to the final unity, when God is seen to be all in all. For everything is fundamentally good as the expression of the creative goodness. Evil is merely negative and has no real existence. But in this final restoration there are still degrees of nearness to God and only the redeemed can enter into mystical union with God. This is the ultimate theophany. Since creation is eternal, predestination is eternally part of creation.

For Erigena creation is always cyclical. This can be seen in all the arts. "Thus Dialectic begins with *Ousia* (the First Principle), descends through genera and returns to *Ousia*. Arithmetic begins with the monad and ends with it. Geometry begins with the point and proceeds through lines, surfaces, angles, length, breadth, and so forth, finally resolving all once more into the point. Music begins with the tone and proceeds through symphonies, simple or composite, and resolves all again into the tone. Astrology begins with the atom and resolves all into it again."[14] This process explains how multiplicity can issue from unity and yet unity remains undivided. Erigena finds number especially illuminating. All numbers are *causaliter* and *aeternaliter* in the monad. "Thence they extend by multiplication into infinity. All equalities have their source in the number

two; all inequalities in the number three; and all species originate from equality and inequality.''[15] But all have their source in unity and return to unity. Erigena finds the cyclical process illustrated in the movements of the celestial spheres, in the seasons, in the generations of animals and plants. ''So in the larger process of the world the primal causes descend into the elements, and the elements into bodies, then bodies are resolved into the elements again, and the elements into the primal causes.''[16]

The creative process, the theophany in which God creates and is created in a mysterious way, is not for Erigena a merely temporal process but essentially an eternal process. The title of Erigena's work—*The Division of Nature*—indicates that the creative process is a process of division (suggesting Bergson's *Creative Evolution*) in which the infinitely potent simplicity of God splits up into a hierarchy of divisions down to the finite individuals of the world as we know it. The logical ladder of Porphyry becomes a genetic descent. But division is only half the truth. The process of creation is as much a process of unification as of division. In conceiving this unification we start in the reverse order from that of division and retrace the hierarchy until we reach the simple source. But really the two processes are one. It is our human mind which distinguishes them. And both the division and unification are eternal; they are not temporal processes, but ways of insight into the meaning of things. Creation is an eternal cosmic dialectic in which we watch the procession from *Ousia,* as the ultimate ground, to *Ousia,* as the ultimate goal. The process of creation is not external to the ground. The whole movement is really within God, and yet God is more than the movement. He is his super-abounding, indivisible, ineffable self. Creation is one eternal act, though we spell it out in parts (708 C). ''God precedes the world, not in time, but in reason, since He is the cause of all, and is Himself uncaused (909 A); and all exists, causatively, in Him from all eternity. Whatever is, is only in so far as the rational grounds of it eternally subsist in God. (640).''[17] Like Hegel's absolute, Erigena's God unfolds himself in the dialectical process of creation.

He is the source, *nisus* and fulfillment of the process. But like Hegel's absolute he remains eternally himself.

For Erigena, knowledge is the basis of existence; things exist because they are in God's knowledge. There is no gulf between human knowledge and divine knowledge. Human knowledge also is creative, for human knowledge also proceeds according to the principle of division. The world does not exist except as the ideas are known by the human mind. But it must be remembered that Erigena is a realist. The human intellect has a direct intuition of the divine ideas. The difference between human creativeness and divine creativeness is that God creates out of nothing, i.e., nothing outside Himself. He is the ultimate source of creativeness. The ultimate dialectic of creation exists in God. There can of course be no separation of knowledge and creativeness, since to know is to create. In making knowledge the basis of existence Erigena again suggests comparison with Hegel. In either case knowledge proceeds by division to a final consummation. But Erigena, unlike Hegel, recognizes that such consummation must be supra-rational.

When we consider the relation of creation to God, Erigena is a thoroughgoing preformationist. But when we consider creation from the point of view of existence, there is a great deal in Erigena's world which must be considered as emergent, i.e., which cannot be referred to God as the First Principle. Thus "the whole world as it now exists, exists in space and time, and could not exist without them. All that is, except God, is known as in space and in time"[18] (468). It is of contemporary interest to note that Erigena, following in the steps of Gregory Nazianzen, holds "that space and time always exist together, and could not be understood apart"[18] (481 C). We cannot separate space and time from existent nature. "Space is natural definition, and mode and position. . . . Time is the motion of things in generation which pass out of existence into non-existence" (483 C). While he thinks that time and nature were created together, he thinks that time is logically prior. With St. Augustine he warns against the error of thinking of space as *supra caelum* (above the heavens) and of time as *ante*

mundum (before the world) (888 C). "There can be no movement when no part of the world is moved, and no time when there is no movement to be measured" (890 B). One thing is clear, viz., that he (like Kant) regards time and space as conditions of existence and not as categories of knowledge. Time and space are implied in motion, and "all movement is part of the universal movement from non-existence to existence —the motion which seeks its end in God, and then rests in Him"[19] (514). Since the creation of the world is eternal, space and time are eternal in the sense that they have no beginning, though, in another sense, they are not eternal since they depend upon God. We may say that time and space are eternal emergents. They have no place in the final consummation. This means merely that they have no place in God. But Erigena is inclined to dramatize this consummation as a grand finale. This is inconsistent with the conception of creation as eternal, though congenial to the imagination. With reference to the final consummation he thinks of the existent world as appearance. "For what exists in space and time and sense has not a real and substantial existence but is a kind of image of real existence. It is like an echo or shadow, with no independent existence of its own"[20] (914 A).

Material things are emergents. They have an immortal origin in the primal causes. "It is form which constitutes and contains all material bodies, and form is incorporeal. Matter apart from form could not be known by the senses"[21] (499 B). Further, material things are immaterial in their composition as well as in their form. If we analyze them, we find that they consist of immaterial qualities. "As Gregory of Nyssa says, matter consists of qualities, and if these are taken away, it cannot be known. That is not a body *(corpus)* which lacks existence and shape *(figura)*, and solidity and difference, and weight, and so forth. None of these qualities is body; each is something beyond and apart from body, but when they are found together (concurrent) there is constituted corporeal substance" (502). If they are taken away, there is left "only formless matter, which, as Augustine says, is merely the muta-

bility of mutable things, which is capable of receiving all forms."[22] Matter is the result of a combination of qualities, "as shadows are formed out of light and bodies" (501). The four simple elements (which we name after fire, air, water, and earth) are themselves invisible, incomprehensible, and universally diffused. "All sensible things are constituted by the proportionate union of these elements, not the direct union of the elements themselves, which are indissoluble and incorruptible, but the union of their qualities, in proportion and opposition. These qualities are four: heat, humidity, cold, dryness (604 C). Heat and cold are active; humidity and dryness are passive (712). These four qualities and the four elements in which they inhere are a kind of intermediary between the primordial causes and composite bodies"[23] (713 B).*

There are also the emergent facts which are due to the theological fall of man. Erigena is in accord with St. Augustine in denying that the material world is due to the fall. For Erigena the world is an eternal revelation of God. But the fall brought certain consequences. It was owing to the fall that man's body became corruptible. God is immortal and creates only the immortal. In the final restoration, the body will be restored to immortality. Sex is the result of the fall. There is no sex in God. Sex carries with it mental differences as well as physical. Intellect is masculine and sense is feminine. But sex disappears in the restoration. Evil, which is the root of the fall, is emergent. Evil is not due to the freedom of the will because this is good. It is causeless for it has no basis in the eternal Ideas. It is a parasite. "It is an abuse of good." "No creature is evil, nor is the knowledge of any creature evil. It is the perverse motion of the rational soul which leaves the Creator, and turns itself to the lustful love of material things, which is evil"[25] (844 D).

* Erigena makes the interesting suggestion that body is not a quantity of *Ousia* but a *quantum*, and colour is not a quality of *Ousia* but a *quale* in a *quantum*. "In nature quantity and quality and *Ousia* are always associated. These are found in all natural bodies; it is only in our intellect that they are separated. *Ousia* is discerned only by the intellect; it is never visible. Quantity and quality are also invisible in *Ousia* but they break forth into visibility in *quantum* and *quale*, when (conjoining themselves) they compose the sensible body."[24]

Not that material things are evil. "There is nothing vicious in any rational creature which is not good in some irrational creature. Ferocity is good in a lion, and filth in a pig, for these things are natural to these animals, but in angels and men they are vices"[26] (967 B, C).

Since evil is not substantial, it will reach its culmination and will be abolished. Like the shadow of the earth, which we call night, it will disappear with the light. But, with St. Augustine, Erigena thinks that "the dark shadow in the picture contributes to the beauty of the whole painting"[27] (953 D). Since "evil is not in the whole of things, so it cannot really be in the parts of the universe, though it seems to be, and is seen as something illicit, which must be restrained and purged. . . . Nothing is left therefore to lesson or to mar the fullness of the whole universe, whether here, while this sensible world fulfils its course, or there, when it has returned into its causes, to rest in them forever"[28] (967). How a temporal, spatial and material world with its drama of sin and restoration can emerge from the eternal creative cause, is a mystery, and must be a mystery, in any monistic system. But Erigena at least holds out the hope that it shall all become clear when the play is over and we find ourselves in God—where we have always been.

Erigena no doubt exercised a great influence on mediaeval thought, both through his own great work and through his translation of the *Areopagitica.* While the *De Divisione Naturae* was suspect through the Middle Ages, it was not officially put on the Index until the middle of the thirteenth century. For over two centuries according to Gilson, it dominated mediaeval thought and, while criticized and finally condemned officially by the Church, it set the standard for the systematic constructions of the Middle Ages. The *Areopagitica* (though actually written in the fifth century A.D.) was accepted uncritically as coming from St. Dionysius and therefore treated with reverence. But Erigena's bold conception of an eternal God creating himself through gradations of universals into the world of concrete

temporal individuals was fought shy of through the scholastic period because of its implied pantheism. Orthodox theology emphasized the distinction between born and made. The world was created by the omnipotence of God, through the wisdom of God, but it was not born of God. This relation was reserved for the Son. Erigena, too, distinguished between the relation in kind which exists between the Father and the Word and the relation between God and the world. The latter is dependent upon God and incomparable with God. Yet the world is a theophany. It exists in God and through its scale of gradations we ascend to union with God. At the end of the Middle Ages, when Scholasticism was losing its grip, the Neoplatonism of Erigena re-asserted itself. His real successors are Eckhart at the end of the thirteenth century, Cusanus in the fourteenth, Bruno in the sixteenth and Boehme in the seventeenth. These, like Erigena, emphasized the world as a self-revelation of God and the immanence of God in the world. God is the unity of opposites and the ground and consummation of its multiplicity.

Cusanus shows the growing individualism of his century by stressing the immanence of God in the smallest (minimum) as well as in the greatest (maximum). If God concretes himself in the multiplicity of finite individuals, these must in their own manner participate in God. Moreover if the many individuals are integral parts of one unity, they cannot be regarded as just separate individuals. There is interpenetration. Each individual in its essence carries the characteristics of all the other individuals. All is in all: *omnia ubique*. Every individual thing "mirrors" the universe in its own way. God, as the universal, passes into the many while he remains eternally one. But though the individual is given in and with the universal, the finite in and with the infinite, yet the finite is contingent while the infinite is necessary. It is only by a mystical knowledge that we can comprehend the derivation of the world from God or find the path from the finite to God. Such knowledge is beyond reason.

Bruno was greatly influenced by "the divine Cusanus" (to use Bruno's epithet). But in Bruno the atmosphere is more

naturalistic. While he retains the idea of God as the unity of opposites and as transcending all finite predicates and, therefore, unknowable in his own essence, he stresses the conception of God "as the inexhaustible, *infinite* word-force, as the *natura naturans* (creative nature), which, in eternal change, forms and 'unfolds' itself purposefully and in conformity with law, into the *natura naturata* (created nature)."[29] We may speak of reality as nature or God, matter or spirit, for God is nature as creative and matter possesses immanent in it the gradations of the forms of spirit. There is no dead matter. All is alive. The cosmos is an organic living whole and its rhythms of growth and decay of solar systems are but pulse-beats of the one all-life. But God reveals himself in the microcosm, the smallest unit, the monad, as truly as in the macrocosm, the whole. "Each monad is a form in which the Divine Being finds individual existence, a finite existence-form of the infinite essence."[30] The infinite life of the whole is individualized in the monad which is eternal and imperishable and which is both corporeal and spiritual. Every individual thing, not merely man, is a microcosm and "mirrors" the world substance. "Each without exception is according to its essential nature the deity itself, but each in its own way, which is different from all the rest."[31] While Bruno's philosophy is aesthetic and naturalistic in its tone, in Boehme the same idea of the eternal self-generation of God is expressed with a fervent religious feeling. Here it becomes a necessity of the divine Primordial Ground, responding to an unconscious urge, to attain self-revelation in the world.

Recently the tradition of Erigena, Cusanus, Bruno and Boehme has found a fresh expression in A. N. Whitehead.[32] Whitehead, in the spirit of his predecessors, conceives the nature of God as dipolar. He has "a primordial nature" and "a consequent nature." "Viewed as primordial, he is the unlimited conceptional realization of the absolute wealth of potentiality. In this aspect, he is not *before* all creation, but *with* all creation."[33] With Erigena he holds that it is the nature of God to create, and therefore to think of God as apart from creation is an abstraction of reason. When thought of thus, God is "de-

ficiently actual." He is conceptional only and therefore lacks "the fulness of actuality." While he is "the infinite ground of all mentality, the unity of vision seeking physical multiplicity,"[34] apart from creation he would be void of consciousness in the subjective sense because this is bound up with physical integration. But he is "the unconditioned actuality of conceptual feeling at the base of things; so that, by reason of this primordial actuality, there is an order in the relevance of eternal objects to the process of creation."[35] It seems that this primordial nature of God is "the acquirement by creativity of a primordial character."[35] This seems dark, but it seems that there is something more primordial than the primordial nature of God, for it "presupposes the *general* metaphysical character of creative advance, of which it is the primordial exemplification."[36] At any rate when we oppose God, as the principle of order, to the world as the multiplicity of finites, "neither God, nor the world reaches static completion. Both are in the grip of the ultimate metaphysical ground, the creative advance into novelty. Either of them, God and the World, is the instrument of novelty for the other."[37]

Perhaps the difficulty lies in attempting even in thought to separate God as primordial and God as consequent. In actuality they cannot be separated. When we consider God from the primordial side, "he is the principle of concretion—the principle whereby there is initiated a definite outcome from a situation otherwise riddled with ambiguity."[38] We cannot understand the world if we leave God out. "Apart from the intervention of God, there could be nothing new in the world, and no order in the world."[38] There would be just "a dead level of ineffectiveness," just "cross currents of incompatibility." But a principle of concretion which does not concrete is of course an abstraction. The primordial nature of God seems to be just a system of postulates which we are obliged to make in order to understand the actual world. But the consequent nature of God "is the realization of the actual world in the unity of His nature, and through the transformation of His wisdom."[39] This consequent nature is subjectively conscious. While the

primordial nature of God is constituted by His conceptual experience and is infinite, free, complete, eternal, actually deficient, and unconscious, the consequent nature "originates with physical experience derived from the temporal world, and then acquires integration with the primordial side." It is finite, determined, incomplete, everlasting, fully actual, and conscious. In making the primordial ground unconscious and having God become subjectively conscious in concreting himself through His wisdom into the world, we seem to have the essential background of the cobbler philosopher, Jacob Boehme. Really God and the World cannot be torn apart: "Each is all in all. Thus each temporal occasion embodies God, and is embodied in God."[40]

This is indeed the language of Erigena, Cusanus, Bruno and Boehme. But there seems to be a certain dualism in Whitehead's system, foreign to his predecessors. The world with its flux and multiplicity is a datum for God, and God with his permanence and unity is a datum for the world. It is clear at any rate that Whitehead regards the rôle of God "as conceptual realization," efficacious "in multiple unifications of the universe." The actuality of God is a multiplicity as well as a unity—"a multiplicity of actual components in process of creation." "This is God in his function of the kingdom of heaven."[41] The actuality of God is "composed of a multiplicity of elements with individual self-realization" and "each actuality in the temporal world has its reception into God's nature."[42] This actuality is present to God not as temporal, but as "a living, ever present fact." It is present to God as the past is to the present. "Thus in the sense in which the present occasion is the person *now*, and yet with his own past, so the counterpart in God is that person in God."[43] Moreover, God is the principle of salvation, of love, as well as the primordial ground of creation.

It is impossible to go into the details of Whitehead's extremely technical presentation. The intellectual climate has undergone profound change in the interval between Whitehead and his predecessors of the Middle Ages and the Renaissance. The latter accepted a certain theological tradition which they tried

to interpret to meet their problems, while Whitehead ostensibly starts with the analysis of human experience as systematized by modern science. But this difference is more apparent than real, for Whitehead really shares with his predecessors the same theological tradition which he tries to adapt to the problems of today as they tried to adapt it to the problems of their day. The main difference appears in the attitude to this contingent world of matter, space and time. For Erigena and his successors, God is almighty and therefore creates the diversity of material occasions with their space and time in which he realizes his forms. For Whitehead the contingent world is as much an ultimate datum as is the ordering principle of God. It is only as the abstract primordial unity that God is infinite and eternal. Whitehead illustrates the saying of Anatole France that, before creation, God is infinite, but ever since he is finite. But perhaps this difference also is more apparent than real. Erigena, too, recognized that space and time and the material basis of things are not part of the essence of God. They are created by God from eternity. They are, therefore, additional data so far as the conception of the primordial God is concerned. What Whitehead calls the consequent nature of God is a creation of God in the temporal world. The order of the world with its gradation of relevant forms from the most universal, through various grades, to the individual is an ingression from the primordial God with his self-sufficient unity of intellectual intuition into the world of contingency. God becomes incarnate in the temporal world as an order of forms or eternal objects.

But God is the principle not only of creation but also of salvation. He is the consummation of the striving of the individual to attain fulness of life or satisfaction through the urge that is in him by virtue of the incarnation of the eternal God in the temporal. God is the beginning, the urge, and the consummation of the process. Since the individual is part of the network of conceptual relations and the creative process converges in him, he is an epitome of creation, a microcosm, a mirror of the whole. This implication is worked out by Cusanus and Bruno, and is a fundamental part of Whitehead's theory. It is not only the

human individual who is a microcosm; everything is a microcosm down to the simplest unit, the monad. The facts, moreover, show that there is a great deal of contingency in the attempt of the finite part to realize its vocation in the whole. There is failure as well as success, and the failure consists precisely in not selecting the proper form. This does not mean that the other forms are bad *per se*. An animal form, Erigena points out, is the proper form for an animal, but it is an improper form for a human being. We are not here concerned with the value of this synthesis, we are merely pointing out that Whitehead is a part of a great tradition, the essential lineaments of which are to be found in Scotus Erigena.

Chapter 2

PREFORMATION IN MODERN THOUGHT

Leibniz and Preformation

Leibniz furnishes us an ideal example of strict preformation, for he works it out consciously both biologically and metaphysically to its extreme limits. In order to understand his theory of preformation we must first examine the fundamental principles of his philosophical system. First of all we must understand what Leibniz means by substance. For Descartes there are two kinds of finite substance, both of which derive from God who is the ultimate substance. These two types of finite substance are mind and body. Mind is characterized as thinking and non-extended and body as extended and non-thinking. All of nature below man consists of extended inert substances which communicate their motion externally. Aside from the soul which may suspend and direct physical motions from its seat in the center of the brain (in the single body, the pineal gland), everything is mechanically determined. Leibniz rejects inert substance entirely. The nature of substance is not extension but force, impulse, *conatus*. This force has no extension. Extension is a confused mass-effect of non-extended force-points. Space is merely an order of relations. Reality is activity and activity of the sort of which we are aware in ourselves. Leibniz starts from the self, which Descartes had found to be the only immediately indubitable fact; and from this starting point Leibniz arrives at the character of the rest of reality by simplification. There is no substance except soul, but soul is not always thinking substance. The activity of soul exists at an infinite number of levels. We ourselves are conscious of our activity at a great number of levels—from that of clear mathematical reasoning to the confused perceptions of a dream. While Leibniz projects reality on the spiritual plane, he is careful to preserve all the pragmatic distinctions. He does not dismiss the physical world as phenomenal. But in fact what we call matter is sleeping soul.

The fact of degrees of consciousness suggests the principle of continuity. He borrows the principle from Aristotle, but he develops it in his own way. In Leibniz' own statement: "All natural orders of being present but a single chain in which the different classes of animals, like so many rings, are so closely united that it is not possible either by observation or imagination to determine where one ends or begins." "All advances by degrees in nature, and this law, as applied to each, is part of my doctrine of continuity." The continuity in Leibniz' world cannot be based upon intrinsic differences in the monads since each monad mirrors the whole. It is based solely upon degrees of consciousness. There is an infinite number of degrees of consciousness, and between any degrees there is always an infinite number of degrees. God is the upper limit. He is absolutely self-conscious. There are no dark corners in God's soul. But below God there is an infinite number of degrees of clearness. Of course we do not come next to God, as we should like to believe. At best we are muddle-headed and know little of what we mean. Between us and God there is an infinite number of degrees—filled in by angels perhaps. And below us there is an infinite number of degrees. We find a descending series through animals and plants down to inorganic matter. There must of course be more animals and plants than we are aware of. Otherwise we could not establish such continuity as is required by Leibniz' differential calculus (the glory of perfecting which he shares with Newton). This little detail does not trouble Leibniz. But what about inorganic matter? Is that absolutely unconscious? No, that would mean deadness, and matter too is really alive and sensitive. The deadness is a mass effect in us. There are still degrees of consciousness or degrees of sleepiness in the inorganic. H. Wildon Carr suggests the criticism that Leibniz has a limit at the upper end but none at the lower end. But to have a limit at the lower end would be to contradict Leibniz' principle that reality is fundamentally alive and somehow conscious—perceptive and appetitive. Plato and Aristotle had a limit at the lower end—blind, contingent matter. But that is just what Leibniz refuses to admit. In the degrees of consciousness there can be no lower

limit without jumping outside consciousness into the non-spiritual. That would mean a philosophy of substantial dualism, the very thing that Leibniz abhors.

The monad is an individual. The principle of individuation is fundamental for Leibniz. As with Bruno, one monad differs from another by its point of view. The monads cannot differ substantially, for each monad is a microcosm. It is a unity of infinite diversity, for it contains within itself representations of all that exists, it is a mirror of all reality. Yet it has no windows, it receives no stimulus from outside, its development is entirely from within, according to the law of its own being. Since there is no compulsion, the monad is free—free to be itself, not to be different from what it is. God alone could have contingent freedom for which there is no necessity. He could have made the monads different. But God's will is determined by his wisdom which is determined to create the best possible world. And who would want the freedom to be unwise? Still it seems that in this smug world of Leibniz, God alone has any choice, if indeed even God has real alternatives: man is only free to be what he is under the limitations which are placed within him by the master of the show—to fit into the show.

While the monad has intrinsic individuality, it is not meant to exist alone. God did not create the monads separately, but he created the monads as groups. The union of the monads is as fundamental and indestructible as the monads. It is implied in the very structure of the monads that they shall fit together into wholes. Nothing exists by itself or to itself. Reality may be conceived as boxes within boxes. You never reach a limit of subdivision. There is always the union of an infinite number of monads which correspond in their activities, so that to an external observer it looks like interaction. Of course there can be no external observer since no monad has any windows. Only God, the maker of the mechanism, and of mechanisms within mechanisms *ad infinitum,* could know how well they correspond —like clocks made to keep time together. (Leibniz uses the language of mechanism, but he really means organism, for the whole is a living whole and the wholes within the wholes *ad*

infinitum are living wholes and act as living wholes, each according to its own bent.) I said only God could know the correspondence between monads. Of course Leibniz must know. He is the omniscient novelist who knows the inner life of the characters without communication—because *he* created them.

The relation of monads to one another is not merely such as to establish continuity of gradations and fitness to telescope into larger wholes—organisms of organisms—but their relation, when we reach the organic plane, is such that the lower or less conscious is subordinated to the higher or more conscious. On the inorganic level—the stone for example—there is no such subordination. In any group of lower and higher the higher furnishes the control or soul of the whole. The controlling monad in any group is called entelechy by Leibniz who borrows the word and the conception from Aristotle. The relation is exemplified in the relation of the human soul to its body. But we find it also at lower levels, in animal and plant life; and it is exemplified par excellence in creation as a whole which is the best possible world—not because the parts are equally perfect, but because they are so constituted as to minister to the harmony of the whole. (This conception of organic relation was stated clearly by Plato in Book X of the *Laws*.) Leibniz accounts for this function of the parts to supplement one another in various wholes and ultimately in the whole of creation by the theory of pre-established harmony, which, theologically expressed, means that God made the monads such that they would play into one another so as to form a perfect whole.

If we leave out theology, pre-established harmony means that there is a law or constitution of the whole and that this is immanent in the parts so that the parts spontaneously act together for the whole without any need of communication with one another, which by hypothesis there cannot be. Leibniz uses the illustration of an orchestra in which the players are so perfectly trained in the score that, without seeing one another, they play a perfect symphony. Carr uses the illustration of the beehive in which the members are supposed to act instinctively for the good of the whole without taking any account of one another.

This, of course, does not correspond to fact, but in any case there is a control by the whole which is immanent in the members, so that they spontaneously subordinate themselves to the whole. According to Carr this control is not causal but ideal. He compares it to the control exercised by the gardner who without altering the laws of growth produces, by the dominance of selection (which is ideal not causal), a better stock. In Leibniz' theological conception of creation, all the possibilities were foreseen and the plan of the future, including the selective gardner, would be included in the winding up of the world, and included in such a way as to be immanent in the members of the groups so that in realizing the plan they would merely be realizing themselves.

While Leibniz appears to start with independent monads, each of which is as complete in itself as Spinoza's substance, requiring nothing beyond itself to explain its behavior, in the end the monads turn out to be mere pawns in the game; and the main thing is not that the monads shall be independent and carry out their own bent, but that they are bent to carry on the game, according to a plan which they cannot see, but which they are duped into feeling is their own plan. They have really the function of Spinoza's modes, though their independent swagger makes them seem very different from the submissive modes of Spinoza. But in fact they are none the less submissive. Why begrudge them the swagger of independence when in fact they cannot help being obedient?

Leibniz thus worked out a metaphysical system of absolute preformationism. But with his scientific instinct he sought also to establish it as a biological hypothesis. There were two theories of evolution in Leibniz' day, that of epigenesis, supported by Harvey, and that of preformation which was called evolution. The theory of preformation in vogue was that of individual preformation, which held "that the actual forms of living beings exist already in the germ, and that in their life as free individuals there is only development and unfolding or expansion, not generation. It carried with it the idea of *emboîtement*, that is, the enclosing of individuals one within another. Thus

all the human race to the end of time existed in Adam when the world was brought into existence at the creation.''[44] The microscope had now come into effective use in science; and distinguished biologists claimed that they had found evidence from observations on incubation ''that the embryo is fully formed, though infinitesimal, before incubation and that incubation was not a process of generation, but merely a process of growth, by absorption of the nutritive material of the egg.''[45] The theory has sometimes been called the *homunculus* theory because it implies that a human being exists as ''a little man'' in the earliest stages of embryological development.

The supposed discovery of individual preformation in biology seemed to work right into Leibniz' metaphysical theory. In his *Système Nouveau de la Nature,* published in 1695, he says (after dealing with the characteristics of rational souls) : ''Now to return to the consideration of the ordinary forms or material souls, the duration which we must attribute to them, in contrast to that which was attributed to the atoms, might suggest that they must pass from body to body, and that there is what is named metempsychosis much as some philosophers speak of the transmission of movement and the transmission of species (the Scholastic theory). There is no such passing. It is here that the transformations of M. M. Swammerdam, Malpighi and Leeuwenhoek, who are the most excellent experimenters of our time, have come to my support and have made it easier for me to affirm that the animal, and every other organized substance, has not its beginning when we are accustomed to date it and that what appears as generation is only development and a kind of growth.'' Leibniz thus lent his great influence to a theory which has played a conspicuous part in subsequent thought. In its extreme form, namely that structures could not arise from an egg in which they were not already present, the theory has long since been abandoned as a result of more careful evidence, but in a more general form it still persists and contains a profound truth.

For Leibniz, the theory of preformation is bound up not only with how souls come into this existence but with what becomes

of them after this existence "at the destruction of the organized individual substance" of the man or animal. "The consideration of this problem has brought me finally to the view that the only reasonable conclusion we can come to is that there is not only a conservation of the soul, but also a conservation of the animal itself and its organic machine, although the destruction of its grosser parts may have reduced it to an infinitesimal state far below the range of our senses, such as it was before birth. Moreover, no one can mark exactly the actual moment of death. It may often be simulated for a long time by a simple suspension of noticeable actions, and in simple animals it is in fact no more than this; witness the resuscitation of flies drowned in water and buried under powdered chalk. . . . It is natural, then, to suppose that since the animal has always been living and organized (and this fact is beginning to be recognized now by persons of great reputation) it will always continue to be so. For if there is no first birth or entirely new generation of the animal it would seem to follow there can be no final extinction or complete death, taken in the strict metaphysical meaning; and that therefore instead of a transmigration of the soul there is only a transformation of one and the same animal, according as its organs are variously folded and more or less developed."[46] As regards the birth into a future existence, as well as the birth into this, Leibniz holds to the preformation of the union of monads as well as of the individual monads; and while again the extreme form of his theory lacks the support of evidence, we must admire his consistency in bringing future existence and this existence under the same laws. In some sense, we may believe, there is preformation for a future existence as well as for this. Thus as the atoms, when truncated under destructive conditions, do yet retain a pattern which makes restitution possible under favorable conditions, so the pattern of the human soul, though truncated by destructive conditions, may complete itself when favorable conditions arise.

Leibniz' conception of the relation of God to individuals and of individuals to other individuals must always seem artificial. If the order of the whole is immanent in the parts, what, it may

be asked, is the use of a God who is external to the order? This has always been the retort to deism. Instead of supposing that God once created the world and then left it to go on its own, why couldn't it always go on its own? If there is an ordering genius of the whole, it must in some sense be immanent in the whole. In the same way, if the parts act as if other parts were present and adapt themselves to them, it seems simpler to assume that the parts are in a certain sense immanent in one another. If that is a mystery, it is certainly a greater mystery to suppose that they were created in some past time to go off as if they did interact. Furthermore, Leibniz failed to save the significance of the individual. We want more reality for the individual than his merely playing out a prescribed rôle, even though the rôle be immanent. But while the artificiality of Leibniz' system of relations must strike us to-day, we should not lose sight of his many fundamental suggestions. The individual is the centre of development and creativeness. All development is self-development. All learning is self-revelation, even though it could not take place except for the action of the environment. We feel under obligation, finally, to Leibniz for developing a daring and consistent theory of preformation.

Kant and Preformation

If the psychological pluralism of Leibniz requires preformation, so does the psychological monism of the great German movement which found its inspiration in Kant. While Kant repudiated this movement in his time, he is nevertheless the logical father of the preformationist tendency of German idealism. Kant laid it down definitely that the human mind makes the system of nature and therefore the order of nature is preformed in the human mind. It is true that for Kant mind does not make the content of nature. This is "given" as a manifold of sensations. These owe their character to the organism, but they presuppose a prod of some sort from a hypothetical thing in itself. Else he cannot account for the difference between hundred thalers in the mind and hundred thalers in the pocket, in other words for the sense of reality which perceptual experience pos-

sesses as contrasted with imaginative experience. But the thing in itself is after all an hypothesis of the human mind and to the romanticists, intoxicated with the omnipotence of thought, it is merely a creation by the mind. And so mind not merely makes the system of nature: it makes nature through and through.

Kant is generally quoted as an evolutionist and sometimes as a radical epigenesist. In his early work, *The General History of Nature and Theory of the Heavens* (1755), Kant tries to reconcile Newton and Leibniz or the mechanical and teleological standpoints. He there outlines in bold strokes a general theory of cosmic evolution and deserves a place beside Laplace, as the originator of the nebular theory, though Laplace was probably not aware of Kant's work. But for an explicit statement of Kant's attitude to evolution we must refer to the great work of his mature age, the *Critique of Judgment* (1790). Here his attitude to evolution has as its background his developed system of philosophy. The passages which are usually quoted to support the claim that Kant is an evolutionist in the Darwinian sense[47] are in their context merely a statement of a possible hypothesis, already familiar in the work of others, but not endorsed by Kant. Kant refers to the effort by Cuvier and others, to prove evolution from comparative anatomy, as "praiseworthy" in its attempt "to go through the great creation of organized creatures, in order to see whether there may not be in it something similar to a system and also in accordance with the principle of production. For otherwise we should have to be content with the principle of judgment (which gives no insight into their production) and, discouraged, to give up all claim to *natural insight* in this field. The agreement of so many genera of animals in a certain common scheme, which appears to be fundamental not only in the structure of their bones but also in the disposition of their remaining parts,—so that with an admirable simplicity of original outline, a great variety of species has been produced by the shortening of one member and the lengthening of another, the involution of this part and the evolution of that,—allows a ray of hope, however faint, to penetrate into our minds, that here something may be accom-

plished by the aid of the principle of the mechanism of nature (without which there can be no natural science in general). This analogy of forms, which with all their differences seem to have been produced according to a common original type, strengthens our suspicions of an actual relationship between them in their production from a common parent, through the gradual approximation of one animal genus to another—from those in which the principle of purpose seems to be best authenticated, i.e. from man, down to the polype, and again from this down to mosses and lichens, and finally to the lowest stages of nature noticeable by us, viz. to crude matter. And so the whole technic of nature, which is so incomprehensible to us in organized beings that we believe ourselves compelled to think a different principle for it, seems to be derived from matter and its powers according to mechanical laws (like those by which it works in the formation of crystals)."[48]

The evidence from comparative anatomy seems to be reinforced by that of the paleontologist whom Kant calls "the archaeologist of nature": "It is permissible for the archaeologist of nature to derive from the surviving traces of its oldest evolutions, according to all its mechanism known or supposed by him, that great family of creatures (for so we must represent them if the said thoroughgoing relationship is to have any ground). He can suppose the bosom of mother earth, as she passed out of her chaotic state (like a great animal), to have given birth in the beginning to creatures of less purposive forms, that these again gave birth to others which formed themselves with greater adaptation to their place of birth and their relations to each other; until this womb becoming torpid and ossified, limits its births to definite species not further modifiable, and the manifoldness remained as it was at the end of the operation of that fruitful formative power."[49]

If we examine the context of these passages we find that Kant refuses to commit himself to a general theory of evolution. In a foot-note Kant tells us that such an hypothesis may be called "a daring venture of reason and there may be few even of the most acute naturalists through whose head it has not sometimes

passed," referring no doubt to his own youthful speculations. He does not regard the hypothesis absurd "like that *generatio aequivoca* by which is understood the production of an organized being through the mechanics of crude unorganized matter. It would always remain *generatio univoca* in the most universal sense of that word, for it only considers one organic being as derived from another organic being", for Kant's paleontologist regards the earth itself as "a great animal." The paleontologist "must still in the end ascribe to this universal mother an organization purposive in respect of all these creatures; otherwise it would not be possible to think the possibility of the purposive form of the products of the animal and vegetable kingdoms. He has then only pushed further back the ground of explanation and cannot pretend to have made the development of those two kingdoms independent of the condition of final causes." As regards the origin of species, Kant does not think that it is *a priori* inconceivable that an organic being should generate another organic being which is "specifically different"; for example certain water animals might transform themselves gradually into marsh animals and these into land animals. But he thinks that there is no evidence of such transformations. He accepts variations as facts. But he thinks that such variations when hereditary must be judged as an "occasional development of purposive capacities originally present in the species with a view to the preservation of the race." He thinks it belongs to "the complete inner purposiveness of the organized being to take nothing up into the generative power which does not belong, in such a system of purposes, to one of its undeveloped original capacities." There can be "no contingent and unpurposive origin of parts" in the species. Otherwise the principle of teleology could be applied for certain only to the original stock.

It is certain that Kant rejects the extreme preformationism of Leibniz. Kant favors what he calls the theory of *epigenesis* as contrasted with *evolution,* as it was then conceived, which Kant suggests were better named *involution.* Both are forms for Kant of the doctrine of pre-established harmony, but this may

be interpreted in two ways. It may be interpreted as evolution (or involution) which is a doctrine of individual preformation. This regards "generations as mere *educts.*" An insuperable objection to the evolution theory for Kant is that it could not account for hybrids. The other interpretation (which Kant favors and which he calls epigenesis) regards generations as *products* and is called "*generic preformation,* because the productive faculty of the generator and consequently the specific form would be *virtually* preformed according to the inner purposive capacities which are part of its stock."[50] He contrasts the Leibnizian theory of evolution, which removes "every individual from the formative power of nature," with occasionalism which regards the union of the Creator with nature as "a mere formality, *a propos* of which a supreme intelligent Cause of the world has concluded to immediately form a fruit, and only to leave to its parent its development and nourishment." He thinks that occasional creation would be less risky than Leibnizian preformation, in view of the accidents of nature, and also more economical, as it would not require to start with "an incalculably greater number of such preformed beings than would ever be developed." He dismisses occasionalism, however, as not to be taken seriously as a scientific possibility.

He regards the theory of epigenesis, or general preformation, as *a priori* vastly more plausible than the evolution theory. "In respect of the things which we can only represent as possible originally according to the causality of purposes, at least as concerns their propagation, this theory regards nature as self-producing, not merely as self-evolving: and so with the least expenditure of the supernatural leaves to nature all that follows after the first beginning (though without determining anything about this first beginning by which Physic generally is thwarted, however it may essay its explanation by a chain of causes)." He finds Blumenbach's explanation of epigenesis the most reasonable. "In all physical explanations of these formations he starts from organized matter." Blumenbach, he thinks, rightly rejects, as contrary to reason, "that crude matter should have originally formed itself according to mechanical laws, that life

should have sprung from the nature of what is lifeless, that matter should have been able to dispose itself into the form of a self-maintaining purposiveness. . . . But at the same time he leaves to natural mechanism, under this to us indispensable principle of an original organization, an undeterminable but yet unmistakable element, in reference to which the faculty of matter in an organized body is called by him a *formative impulse* (in contrast to and yet standing under the higher guidance and direction of, that merely mechanical *formative power* universally resident in matter)."[51] But while Kant finds general preformation more plausible than individual preformation (Leibniz), he does not commit himself to a general theory of evolution. He is clear that life could not have originated from matter, since matter is characterized by lifelessness and inertia. A general theory of evolution would necessitate a teleological view of nature and such a view is speculative for Kant.

We must now try to see Kant's biological theory in connection with his system. For Kant neither mechanism nor teleology is to be regarded as a metaphysical principle. They are valuable and indispensable instruments in dealing with phenomena. But they are regulative ideas which the mind brings to nature. They are not ontological principles. While for scientific purposes we must pursue the mechanical description of nature as far as we can, Kant does not think that mechanical categories alone are sufficient to describe the activities of organisms. The phenomena of growth, reproduction and restitution must be interpreted teleologically, as though nature realized purposes. There is no real contradiction here, because we can conceive of purpose as realizing itself through mechanisms. But while we must interpret nature teleologically, that does not mean that we can prove that nature itself has purpose. The conception of nature as purposive is a regulative idea, due to the constitution of our mind. It is not constitutive. We cannot indeed think of nature as teleological without thinking of a noumenal or supra-phenomenal cause which works teleologically, but this is merely a necessity of our thought. It does not inform us about reality itself.

There is no way of demonstrating the existence of an infinite,

omniscient, all-benevolent God from the evidence of teleology in nature. This Kant had tried to show in his *Critique of Pure Reason;* and he argues the matter at length in his *Critique of Judgment.* He always comes back to the same point, namely that "the principles of the mechanical and teleological methods of production of organic beings of nature . . . are merely principles of the reflective judgment in respect of nature as it produces forms in accordance with particular laws (for the systematic connection of which we have no key). They do not determine the origin of these beings in themselves; but only say that we, by the constitution of our Understanding and our Reason, cannot conceive it in this kind of being except according to final causes."[52] To presume "to extend at pleasure my very limited concept of that original Understanding (which I can base on my limited knowledge of the world), of the might of that original Being in actualizing its Ideas, and of its Will to do so, and complete this into the Idea of an All-wise, Infinite Being . . . would presuppose omniscience in me, in order to see into the purposes of nature in their whole connection, and in addition the power of conceiving all possible plans in comparison with which the present plan would be with justice regarded as the best."[53] This seems a sufficient refutation of Leibniz. But the teleological view is inevitable, even though it is a contribution of our understanding.

What about the production of this understanding which views nature teleologically? Can we argue from this to a Supreme Cause, a Supreme Understanding, analogous to ours, which we can worship as God? Kant thinks not. "The theoretical investigation of nature can never reveal to us whether this Understanding may not also, with the whole of nature and its production, have had a final design (which would not lie in the nature of the sensible world). On the contrary, with all our knowledge of nature it remains undecided whether that Supreme Cause is its original ground according to a final purpose or not rather by means of an Understanding determined by the mere necessity of its nature to produce certain forms (according to the analogy of what we call the Art-instinct in animals); without it being

necessary to ascribe to it even wisdom, much less the highest wisdom combined with all the properties requisite for the perfection of its product.'"[54] This is a keen remark of Kant's. We cannot in formal logic argue validly and cogently from the consequence to the antecedent. (When we do so argue, as in scientific hypothesis, we deal with probabilities.) The Supreme Cause of our understanding need not be an understanding like ours.

But this should have prevented Kant from arguing from our moral consciousness to a God whose one function it is to guarantee our moral order. Kant had a partiality for morality as the supreme value of the universe. But a man who feels that knowledge is the supreme value would have the same right to postulate a God to sponsor his conception of knowledge; and a man who feels that beauty is the supreme value would have a right to postulate a God as sponsor for his type of appreciation of beauty. Even though we suppose that, in each case, the individual type of valuation may be taken as the universal human type, this would not essentially alter the fallacy. To combine the three human types of value—morality, knowledge, and beauty—into an idea of God would be merely to repeat the fallacy three times. In any case, the question remains: Have we a right to apotheosize human ideals? And if so, why one more than another?

The successors of Kant were more ambitious or less scrupulous. They did not hesitate to apotheosize human nature. For them the ego makes not only the order of nature but the content of nature as well. This ego, which makes nature through-and-through, turns out to be an absolute ego. This alone is absolutely real. But reality is the sort of thing which we know in our inner experience. Of this, the world of sense experience is an appearance. Space and time are forms in which the ego stages its phenomena. Space is the form of externality in which the ego stages the diversity in the sense world, and time is the form of succession of events whether in outer or inner experience. But these forms are limitations of our finite experience. They have no relevance to the absolute ego. What status can nature have under these circumstances? Fichte, the ethical idealist, follows Kant in apotheosizing the moral order. The absolute

is the moral order; and nature is posited by the ego as the stage or instrument for realizing the moral law. Fichte started life as a goose-herder, and this may have had something to do with the arbitrary way in which he identified his own will with the moral law. Nature is the way in which the ego projects its sense-life into an order of space, time, causality and other categories, imposed *a priori* by itself; but this sense-life is only raw material to be re-created into a moral order. That is the vocation of man. In the absolute ego this order is eternally realized, which is merely saying that the moral order eternally exists, for the absolute has no consciousness except in us. To the absolute, which is beyond moral striving, nature can have no metaphysical significance. The aesthetic aspect of nature had no appeal for Fichte, and, therefore, he was able to dispose of nature in this summary fashion.

Schelling and Preformation

Schelling, the chief of the romantic idealists, was a poet by temperament and in his youth showed a romantic enthusiasm for nature. He had been inoculated with the transcendentalism of Kant and Fichte. He also had absorbed the idea of evolution and other bits of the science of the day. So equipped, he proposed to make good the deficiency in Fichte's system and give nature a real status. He set himself to develop the ideal from the real. Nature is self-contained and possesses the principles of explanation within itself. These principles can be deduced *a priori,* but because they are objective principles they can be verified in experience. Schelling's theory of evolution is pregnant with suggestions, but because of his romantic temperament and his varying versions, it is not easy to state what his theory is. While nature is to be self-contained, there is always the transcendental background. We may say that his theory implies universal preformation as contrasted with empirical emergence. Nature must be deduced *a priori.*

In a fragment of a poem, "Epicurean Confession of Faith of Hans Bristleback,"[55] he compares nature to a giant spirit, restlessly dreaming. He is travailing throughout nature in what

seems dead and in what is alive. He is ever struggling to realize his urge to arrive out of darkness into light. Being ever intent on life, he conquers his cruel environment, fashioning organs and members until he finds that form which is worthiest of his mind and comes to himself in the dwarfish race of man and marvels who he may be. At last he rises to self-consciousness and discovers that he is the God who fills nature's bosom. He is the life that thrills in her heart's blood. He is the mystic power that from the beginning has wrested a new created world from chaos. It is he who reveals himself in the forms and beauties of nature, ever pressing onward until nature stands revealed in thought's eternal truth. Throughout there pulsates the one all-sufficing power which sacrifices what is attained to reach its consummation.

Schelling is impressed with the infinite productivity of nature. But this productivity would be futile except for an inherent tendency of limitation. The productivity does not just go on and on in endless change, but it works to realize totalities and grades of totalities. These grades for Schelling are, first, matter which is the equilibrium of the forces of expansion and repulsion; then light, which subsumes under itself magnetism, electricity and chemical action (galvanism); and finally the organism which includes the previous totalities and has for its component phases, reproduction, irritability and sensibility.

The dialectic of nature works by thesis and antithesis, which find their meaning in a new synthesis. He was impressed by the polarity in magnetism and electricity, the positive and negative poles, and tried to trace it throughout the evolution of nature in plant and animal, male and female. But he was not misled by the dichotomy of language to find a polarity in organic and inorganic. These are not opposites in nature nor would he reduce them to a common expression. Matter and life are grades of totalities. "The latter," he says in his *Philosophy of Nature*, "is only the higher *power* of the former, and is produced only by the higher power of the forces through which the latter also is produced. But the difference between organic and inorganic nature is only in nature as product; nature, as originally pro-

ductive, transcends both." By virtue of his fundamental assumption of an infinite productive activity which finally comes to self-consciousness in man, Schelling tends from the first to universal animism. In his early philosophy, matter has dignity as the lowest totality in which creative nature reveals itself and which is presupposed by the higher stages. Later, however, he tends to degrade matter. The inorganic as such has no existence. It is a descent, a defection from the organic. This was a necessary consequence of his transcendentalism, though matter in his earliest statements was always more than matter, when considered from the point of view of the absolute. In the infinite productivity, it had potentialities beyond itself. In fact the whole process of evolution could be deduced *a priori* from the immanent productivity.

It would seem that a philosophy of evolution as a one-way process should include mind as a stage, the final inclusive totality, in the productivity of nature. But the philosophy of nature for Schelling stops with organic evolution which is carried to the borders of mind and even includes what we are accustomed to think of as the more primitive functions of mind. Mind, however, for a transcendental idealist must have a privileged position. It is prior to nature. Nature must be shown in the last analysis to be the creation of mind. Spirit is not just the last step in a long process of evolution, but it is the absolute reality. This raises serious problems for Schelling in the development of his philosophy. He tried first to solve the problem on the basis of the double aspect theory which he took over from Spinoza. The physical and mental are parallel phases, the expressions of an identical substance. Schelling stresses at first the indifference or neutrality of the ultimate unity. But it was easy to confuse the metaphysical contrast of mind and nature with the psychological contrast of subject and object. He overlooked the fact that the subject-object relation of linguistic thought holds for our knowledge of other minds as well as of physical nature. But at any rate the relation of neutrality did not seem an adequate synthesis of the knowing subject and the object-to-be-known. So Schelling, always a poet, took refuge in art.

In artistic appreciation the duality of subject and object is overcome. The subject loses itself or finds itself in the object. In the last period of Schelling's development, mystical union takes the place of artistic appreciation.

Schelling's development has interest for us as showing that a real philosophy of evolution is incongruous with a transcendental psychological idealism. That does not mean that later movements might not have learned much from Schelling's flashes of insight. We may be amused at his *a priori* manner of treating science, for example his placing light as a higher totality than matter. But we should not forget that it was the same will-to-believe which led sentimental idealists in our own day to regard electricity, which now is regarded as the basis of matter, as more spiritual than atoms, and to think that we are getting nearer God when we talk in terms of the more general category of energy than when we talk in terms of the special organization of energy which we call matter. Schelling at any rate had a better excuse than the sentimental idealists of to-day, for in the first enthusiasm of the discoveries in the field of light, magnetism and electricity, this field had a romantic halo for scientists, as well as for philosophers. In spite of his limitations in science and logic, Schelling cannot be denied some germinal insights. The idea of polarity has been shown to be basic in the foundations of nature, though we know little about it as yet. Heraclitus had shown that opposition and conflict are essential to any advance in nature and society. The real harmony must be a harmony of tension. Heraclitus' concept of opposition is much broader than that of polarity. Not all opposition resolves itself into a simple duality. Yet polarity is a concept of fundamental importance in nature and perhaps some day we shall understand the why of it. Schelling's suggestion of the limitation of the stream of change into forms or totalities, and a hierarchy of totalities in which the higher totality includes the lower, shows the insight of the poet. But the germinal insights of Schelling were lost in his multitudinous and technical systems and have had to be rediscovered. They made no connection with the great evolutionary movement of Darwin-

ism, which approached the problem from the side of mechanism, not transcendentalism. At one point Schelling seems to have connected with a recent evolutionary philosophy, that of Bergsonism. I refer to the vitalism of Bergson and his theory that matter has no metaphysical status, but is a descent from life. This is, I think, a connection of doubtful value.

I am led to remark that what has value in Schelling are the elusive suggestions of the poet, rather than his painful dialectical elaborations, never satisfactory to himself. The latter were the result of his trying to conform to the atrocious fashion of the philosophy of his day, just as the attempt to conform philosophy to the language of mathematics is a stupid fashion of our own day. Had Schelling dared to follow his genius, as his first wife, Caroline, so wisely urged him to do, he might have been one of the most influential philosophers in a new age, if not in his own. Schopenhauer, also a poet, did dare to choose his own medium of expression and, though ostracised by the pedants of his generation, became the most influential philosopher of a later generation. In the main I agree with Yeats, a contemporary poet: "Whatever of philosophy has been made poetry is alone permanent," though of course we must take poetry in its large modern sense. But most men are too eager for the loaves and fishes to brave the contumely of the too influential obscurantists.

Hegel and Preformation

The place which Hegel assigns to nature in his scheme of reality shows close dependence upon Schelling. Schelling started with the concept of nature as spirit asleep and (in the lowest stages) frozen. But it asserts itself in a hierarchy of totalities or stages until it becomes awake and knows what it is doing. With this awakening the story of nature terminates and the story of spirit begins. This seems to imply the dialectical emergence of self-conscious mind from nature. But this idea was repugnant to Schelling. The relation of mind to nature is really timeless. They are two sides of the same shield. This is the philosophy of identity and harks back to Spinoza's parallelism. Hegel revolted against the philosophy of identity and instead

sought the type of concrete unification in self-consciousness, where the opposition of nature and mind is absorbed and transcended. The comprehensive, fully self-integrated and self-conscious individual is the Absolute. This final motive is clear enough. But in the dialectical autobiography of the Absolute in the Logic it becomes necessary to take the categories of nature twice. First the categories of common sense and science are taken up in the second part. They have to do with a concrete and self-subsisting stage of reality, but one which exists *an sich* and not *für sich,* i.e. they are reality abstracted from consciousness. Since the form is immanent in the content and manifests itself in the content, we forget that it exists only for a subject. Hegel's development of the doctrine of Essence is, I think, the sanest and most suggestive part of the Logic. It is empirical and not merely lexicographical, as is the doctrine of Being. His doctrine—that the essence appears, that its actuality is activity —is profound, although his method is artificial and lexicographical.

When Hegel reaches the third part of the Logic or the Notion he tries to show the unity of reality in self-consciousness. We must no longer regard the object as existing by itself, independently of the subject. Its nature is to be object for a subject. But in Hegel's paradoxical method it is necessary first to oppose the factors that are to be unified. So in order to show the unity of the subjective and objective, he opposes them and develops each theme independently. The development of the subjective aspect follows the method of formal logic. He gives an elaboration of judgment and inference, in order to combine the abstract aspects of universality and particularity into an equally abstract individuality which is merely the union of the two. But if Hegel adopts the shell of formal logic, he also shows its limitations in dealing with the concrete. Contradiction in our findings does not mean failure, but a spur to go on and find a more comprehensive point of view in which the apparently contradictory aspects find their meaning in a new totality. Reality is not to be understood as the abstract *either or* of the law of excluded middle. Reality exists in totalities. Since all

totalities, short of the Absolute, are relative, a new opposition always develops and with it a demand for a new resolution, until the Absolute, the really comprehensive whole is reached.

Opposed to the subjective Notion is the Object under which Hegel brings in his philosophy of nature, not merely as general categories, as in the second part of the Logic, but as a dialectical survey of the whole field of natural science which he arranges into the hierarchical stages of mechanism, chemism and teleology. The latter bridges the gap between the subjective and objective since it contains an immanent subjectivity—the end or purpose. We must remember that the objective is a sphere of logical operation as much as the subjective; and Hegel shows how the various forms of the syllogism are implied in nature as object. Teleology becomes the cue for introducing the Idea "which is truth in and for itself,—the absolute unity of the notion and objectivity." We seem to have reached the goal when we reach the Idea. "The stages hitherto considered, viz. those of Being and the Essence, as well as those of the Notion and of Objectivity are not, when so distinguished, something permanent, resting upon themselves. They have proved to be dialectical, and their only truth is that they are dynamical elements of the Idea."[56] Of course we have a shock when we find that the Idea does not know all this and that we are thrown back on the Idea as immediacy or life which has to rise to cognition with its duality before it can reach the final consummation of the Absolute Idea. But at last we feel that we see the place which Hegel assigns to nature in his logical system.

Hegel published his larger *Logic* in 1812. His smaller *Logic* is the introduction to his encyclopædia (or series of textbooks on philosophy) which he published in 1817. Following the example of Schelling, to whom he is more indebted than he owns, he decides to start his real biography of the Absolute with a *Philosophy of Nature*. To do this he must indicate how the Absolute finds itself in this state. We are shocked to learn that there has been trouble in the Absolute. In the Logic, the opposition of subjective and objective is a dialectical diremption to show that both are aspects to be integrated into the absolute

unity of self-consciousness, which is reality for itself, i.e. reality as known. But in the philosophy of nature we are confronted with "the broad ugly ditch" with which Schelling taunted Hegel. Here we see nature as the "self-estrangement" of the Absolute. The story of nature is the dialectic of the Absolute in its "otherness," through various stages, until it comes to itself, recovers from its lapse of consciousness and regains its sanity. But perhaps the situation is not so bad as that. Hegel hints darkly that the Absolute conceived a Son (an idea he attributes to Philo). That may be difficult to understand. But if we just accept the fact, it explains the seeming lapse of the Absolute without throwing doubt on his sanity. The Son must of course grow up and become conscious of himself, and the *Philosophy of Nature* is really the biography of the Son until he rises to mature self-consciousness and recognizes that he is one with the Father and really was so all the time, only he did not know it. Really he did know it, of course: the dialectical process is merely our human method of becoming conscious of reality. We are of course tempted to ask Hegel: Why didn't you tell us so in the first place? Why didn't you start with reality instead of hoodwinking us all the time with abstractions? Hegel forestalls our question, however, by anticipating it; and his answer is that if he had done so, he should have had to define his terms and then he would have had to marshal his concepts just as he has done. But the real reason, of course, was that he was a professor and wanted to impress us by keeping something up his sleeve.

Hegel's *Philosophy of Nature* is a marvelous and perplexing work. It is a monument to the industry of this methodical philosopher. He tells us that he had devoted twenty-five years to its problems. In his own time the *Philosophy of Nature* was the most popular of his works, but it makes curious reading now. The fundamental conception of the work, viz. to exhibit all the concepts of nature in a morphological order, is certainly worthy of admiration, even though it is a desperate undertaking to-day. The totalities or *Gestalten* which mark the climax respectively of the three stages—mechanism, chemism and organism—are

admirably conceived. And one must admire the faith that there is a structure or dialectic immanent in nature which moves by implication from the beginning to the end, only to point the way to a still higher unity in which nature is in turn subsumed. Hegel's bias for the triad of thesis, antithesis and synthesis is sometimes strained and artificial but nevertheless impressive in its progress.

Within the general frame work, he tries to embody the science of the day, and he seems to have been an alert reader. But he does not hesitate to criticize scientific theories and to make his own interpretations, which are sometimes decidedly naïve. He starts with the opposition of space and time. Space is the general form of externality or side-by-sideness, but it is continuous, for its externality is abstract and contains no distinctions. Time is also abstract in an opposite sense. It is the negative phase. It is the being that, in-so-far as it is, is not and, in-so-far as it is not, is. It is the immediate fluency of distinctions. Like space it is continuous. Hegel, like S. Alexander, was tempted to contrast time with space as subjectivity to objectivity—time as "the soul of space." But Hegel did not yield to the temptation. It should be noted that space and time are not subjective forms as they are for Kant. They are grasped in immediate intuition, but they are real characteristics of nature. The whole drama of dialectical development in the philosophy of nature is within nature. The dialectic is immanent in the structure of nature, not superimposed upon nature by the activity of mind. Our knowledge is purely objective or neutral in the process. It merely discovers or takes account of the implications.

It would seem then that Hegel, so far from being a subjective idealist, is in fact a naïve realist. The order of nature exists of course for mind, but the subjective activity of taking account of nature does not alter nature. The forms and properties of nature exist in nature itself. Nature appears as she is in the act of apprehension. The forms of nature can be grasped as they are, and so can the qualities. This is true of the so-called secondary qualities as well as of the so-called primary qualities. Colour is not in the light. Light contains no difference. It is purely homo-

geneous. It has no existence for itself. It is bodies which reveal light and light in turn reveals the qualities, including the colour, of bodies. The existence of light is the inseparable and simple existence for another.[57] What concerns us here is that, for Hegel, the order and properties of nature are immanent in nature.

It is true that the Idea is only imperfectly realized in nature. But the Idea strives to realize totalities (*Gestalten*) in nature. "First, in the stage of material bodies, the Idea attained to the freedom of realizing a mechanical whole of which the free heavenly bodies are members. Then she transformed the externality of the first stage into properties and qualities which in the chemical process belong to an individual unity with immanent and physical movement. In the living organism, matter is transformed into members of a whole in which there is realized a subjective unity."[58] It is difficult indeed to reduce the material of nature to the unity of reason, and there is danger of losing the principle in the details. "But, in spite of this, reason must hold fast to the faith that in nature mind speaks to mind and that the true structure (*Gestalt*) of the Idea which lies hidden under the externality of an endless variety of forms may be revealed."[58] The purpose of the book, Hegel tells us, "is to coërce the Proteus of nature to yield such a picture that the externality of nature shall become the mirror in which we discover ourselves and see in nature the free reflection of spirit: recognize God, not in the contemplation of spirit, but in its immediate existence in nature."[59]

The realization of spirit in nature is not complete. It is but prophecy of its complete emancipation. There must be the metamorphosis of spirit into a still higher stage, which transforms nature into itself. "The goal of nature is to die in order to break through the shell of the immediate and sensuous, to burn itself up as the Phoenix in order to come out from its externality, rejuvenated as spirit. Nature entered into otherness, in order to recognize itself again as Idea and to reconcile itself with itself."[60] This does not mean merely to pass from objectivity to subjectivity which is merely the complementary aspect and therefore equally relative. It must realize itself as the

power of free spirit. This exists for itself, just as much before nature as after nature. "As the goal of nature it is before nature. Nature proceeded from it, not empirically but so that she is ever subsumed in the spirit which she presupposes." The inner necessity of nature is the deed of free spirit and is not a constraint since it is nature's own deed, for nature is spirit. Spirit will free itself by coming out from its externality, grasping its meaning and re-creating nature by its own free deed. This act of the spirit is philosophy.

I have not tried to follow Hegel through the details of his philosophy of nature. It would at best be a tedious and curious business. In some respects Hegel seems reactionary in his attempt to bring science into line with metaphysics. We can sympathize with him in his protest against erecting mathematical formulae, such as the law of gravitation, into metaphysical laws of nature. We know now that Newton's law is a pragmatic approximation which requires correction for certain purposes, and so we have Einstein's equations which should be looked upon as similarly pragmatic. But we cannot sympathize with Hegel's animus against Newton. He feels that Newton had received undeserved credit and magnifies Kepler at Newton's expense. (He also supports Goethe's theory of colour as against Newton's.) Instead of interpreting the solar system gravitationally, he interprets it as an organic whole in which the bodies move by their own impulse and express a *Gestalt* in which the parts exist by virtue of the whole and the whole by virtue of the parts. The planets determine the centre and the centre the planets through the immanence of the Idea. He even suggests that the sun is originated by the planets. He thinks of light as a sort of phosphorescence. He had read or heard of a book, by a French general, in which the latter advanced the theory that the sun is losing light, but suggested that the water vapour which is very light may rise to restore the loss to the sun. This takes us back to Heraclitus.

Hegel rejects Newton's corpuscular theory of light as absurd, but he also rejects the undulatory theory, for light is simple and homogeneous and has existence only in another. He of course

rejects the material conception of light which is implied by Newton. He quotes an experiment to show that light has no weight. He would prefer to believe that the action of light is instantaneous. He objects to Roemer's proof of the finite velocity of light. Roemer measured the difference in the time of the appearance of light from the moons of Jupiter as they revolve in their orbits. Hegel thinks the difference might be due to the medium. We cannot say, therefore, that light in interstellar space must have finite velocity. It strikes him as a ghastly idea that light might reach us 500 years after it started (and was dead), as Herschel had calculated from variable stars. In his ideas on electricity, Hegel follows the evidence of his time, and accepts (like Schelling) the advanced idea that chemical action is electrical. This fits in with his need to make chemism an actualization of electrical action when the externality of two bodies is overcome. He refuses to regard plants as true organisms and thinks they merely consist of living parts. Animals alone are true organisms with self-direction or inner subjectivity. But even animals are imperfect individuals. They are merely exemplifications of the species. They have no immortality as individuals. In general we may say that Hegel used science only as it served his metaphysical interests.

The important question for us is not Hegel's knowledge or use of science, but his conception of evolution. Is there real evolution in nature? Hegel warns us repeatedly not to think of one stage of nature as producing another. He rejects both the Leibnizian theory of preformation (which he refers to as the box-within-box theory) and Harvey's theory of epigenesis. The process in which Hegel is interested is a logical process—the relation of logical implication. "It is a foolish blunder, though well known both in the ancient and recent study of natural philosophy, to regard the continuance and transition of one natural form and stage into a higher as an actual and external process of production—which, however, for the sake of clearness is always pushed well into the darkness of the past. Nature is precisely that externality which allows differences to fall asunder and present themselves to view as separate existences

indifferent to each. The dialectic which leads from stage to stage is the *inner* force of nature. Real thought must reject such nebulous and essentially sensuous fancies, especially the alleged *origination* of plants and animals from water, and also the subsequent *origination* of the higher animals from the lower."[61]

Nature is regarded "as a system of dialectical steps where one necessarily proceeds from the other," but this series is not to be thought of "as though one were naturally produced from the other. The relation is one of internal necessity through the immanent Idea which constitutes the structure of nature. The metamorphosis belongs only to the notion as such; its change alone is development. The notion, however, exists in nature partly only as necessity, partly only as a living individual. It alone, therefore, has the capacity of actual metamorphosis."[62] But this metamorphosis is merely a logical transformation. It is not a temporal evolution. There is thus no evolution, in the ordinary sense, in Hegel's system. To compare conflict and survival in Darwin's theory with Hegel's logical opposition of concepts and their resolution into a higher concept by an immanent system of implication, is to compare incommensurables. We may say that Hegel is a preformationist. He does not, however, believe in the pre-existence of a miniature man or animal in the embryo, but regards preformation as a logical chain of concepts which exists eternally in the Absolute and is immanent in nature. Nature with its variety of forms and stages is a theophany.

It is true that Hegel has much to say about contingency in nature. Sometimes his language is strongly reminiscent of Aristotle's primitive contingency. In the *Logic* contingency is a category opposed to possibility, but both are taken up and resolved in the higher concept of developed actuality, which is both necessity and freedom, and all is well. The problem of philosophy is "to elicit the necessity concealed under the semblance of contingency." But in the philosophy of nature contingency seems to have a more real place. "The contradiction of the Idea, grown external to itself as nature, may be more closely defined as follows: on one side, nature necessarily arises from the Notion of

its several forms and of the rational unity of these in an organic whole; on the other side, nature implies indifferent contingency and indefinable lawlessness. Contingency and determination from the outside have their rights in the sphere of nature. . . . The impotence of nature shows itself in its maintaining only in the abstract the determinations of the Notion, while leaving details to be filled in by forces external to the individual. . . . The impotence of nature sets limits to philosophy. It is most perverse to ask the Notion that it should conceive, construe, deduce such contingent existences."[63] This reads like Platonic dualism and one suspects that the *Naturphilosophie* is really a system of Platonic Ideas, rather than an attempt to account for empirical nature.

In a sarcastic foot-note, Hegel replies in this connection to a Herr Krug (who seems to have asked Hegel to deduce not merely a work of art but a writing quill, i.e. to deduce individual things) that when science should have advanced so far and when there is nothing more important to do, it might perhaps be done. But it is not the unimportance of the writing quill that is in question, but whether any individual, temporal thing could be deduced by Hegel's method. We share Herr Krug's doubt in that regard. The use of the contingent, with Hegel as with Aristotle, is not to explain individuality, but malformations—in short the impotence of nature. But such dualism, it is needless to say, is destructive of the whole spirit of Hegel's philosophy. There should be no place for the really contingent—a surd of irrationality—in Hegel's system; accordingly in the *Logic* it properly evaporates as a category. The necessary and contingent are eternally transcended and transmuted into self-determination.

Any reader of Hegel to-day must be impressed with the artificial character of his dialectic—his game of having linguistic opposites generate one the other and then set up a mock fight between themselves in which they conceive an offspring which in turn devours its parents, until everything is engulfed and digested in the capacious maw of the Absolute, "where the wicked cease from troubling and the weary are at rest." Even the devil, so essential to the process as the principle of negativity, is sub-

limated in the absolute whole. But linguistic abstractions have no generative power. Once aspects are severed from the real matrix, they are sterile. They can no more be united, still less unite themselves, than can the pieces of the broken Humpty Dumpty in the familiar tragedy. In justice to Hegel it should be said that he does not always conceive the dialectical movement as really productive. He sometimes regards it as an unfoldment of the concrete consciousness. If not an unfoldment of the Absolute through Hegel, it is no doubt an unfoldment of Hegel's social consciousness as condensed into language (the German language, often untranslatable). Hegel is at his best, therefore, when he deals with social products, such as art and institutions.

It is needless to say that you cannot get an individual by combining abstract categories. Particularity and universality will no more unite than oil and alcohol. They do not as abstractions imply each other. The so-called "concrete universal" is a hybrid monster, in the same class with mermaids and centaurs. Universals must be abstract to function as universals. Both particulars and universals are functional terms. When we emphasize the similarity of function which makes it possible to classify individuals in one group, we may give this aspect the name of universality; and when we emphasize the difference in function, which makes it necessary to distinguish individuals, we may call this their particularity. But this is merely the pragmatic treatment of individuals. Though this may be convenient for certain purposes, it does not constitute the individuals. This is putting the cart before the horse. Individuals in nature are not logical entities, though they lend themselves to logical treatment. They are energy-syntheses, not logical syntheses. It is easy to see why men interested in the real affairs of social reform and in the movement of actual history, like Engels and Karl Marx, felt obliged to throw the Hegelian system overboard and to substitute a temporal dialectic, with real emergence, for Hegel's abstract dialectic. Even so they felt they were true to the deeper insight of Hegel which his pedantry had obscured—the struggle between opposing social forces through which a higher synthesis

emerges, only to give rise to a new struggle and a new equilibrium. Hegel's Absolute for them becomes a faith in absolute progress. This seemed a great simplification. But what guaranty can there be for absolute progress in a materialistic world-view? You cannot both eat your cake and have it.

In spite of Hegel's tendency to construe the world *a priori* and his patronizing attitude to the empirical sciences, we must admire his faith that nature can be viewed as a hierarchical structure of *Gestalten,* with a progressive significance of wholeness, until everything finds its meaning in one comprehensive unity. His protest against the crass mechanical view of the universe and his insistence upon intrinsic structure were based upon a sound intuition and have been justified by the science of the twentieth century. But the very thoroughness of Hegel's method defeats his aim to give a real status to nature. It is difficult to see what place is left to nature, as we know it, with its plurality of histories, when it is integrated, as it eternally must be, into the Absolute. This difficulty, however, Hegel shares with all monistic interpretations. A more pluralistic conception has the advantage that it can give significance to the stages of nature and man on their own account, without swallowing everything up in one whole. The *each's,* to use William James' language, have their claims as well as the *all.* The Absolute, moreover, as even F. H. Bradley came to realize, cannot satisfy the religious needs of man. The human spirit does not seek rapport with the all, but with the best part of reality. This best must be an individual best on whom our spirit can lean for encouragement and strength in its fragmentary efforts to realize the best.

It is a weakness in Hegel that he did not have the poet's love of nature, at any rate in its large aspects. His philosophy is a reaction against the sentimentalism of his time which exalted nature at the expense of man. Hegel, in leaving a broad ditch between nature and man, failed to recognize that man emerges out of nature and is part of nature. The failure to recognize the continuity of man with nature led to Hegel's artificial dualism between the subjective and the objective. But this was the consequence of Hegel's rejection of evolution. There is for Hegel

no temporal emergence. There is merely dialectical emergence. Hegel was right that a natural history is not a philosophy of nature. The naturalistic view necessarily misses the architectonic principle of nature without which nature has no meaning. Hegel is right, too, that the humblest flower is of more significance than a star from the point of view of understanding the architecture of nature. But in "the sense of presence" which the great poets have felt in nature we must recognize one way in which the human spirit has entered into a relation of intimacy with the genius of nature; and without this direct acquaintance the logical description of nature must remain but an empty shell. This intimacy with nature in the large was not vouchsafed to Hegel. The mountains of Switzerland merely depressed him with their waste and the stars of the nocturnal firmament were to him so many gnats.

Yet Hegel was not lacking in a sense of beauty. No one has had a clearer insight into the meaning and value of art as the expression of the human spirit. He had an appreciation of the fleeting values as well as the permanent: "We are prone to value the enduring more highly than that which soon perishes. But all flowers, all beautiful life, meets with an early death. But the most excellent also endures—not only the lifeless, inorganic universal but also the concrete universal, the kind, the law, the Idea, the Spirit. . . . The most beautiful life is that which unites the universal and its individuality into a perfectly realized whole (*Gestalt*)."[64] With this we must agree.

Schopenhauer and Von Hartmann

Schopenhauer was more imbued with the spirit of evolution and tries to account for the facts of evolution, as he understands them, within his system. He accepts in the main Kant's theory of knowledge. The world as we know it is our idea. It is projected in categories which our mind supplies, viz. space, time and causality. But we are conscious of something deeper than the world of knowledge—something upon which the world of knowledge, with its categories, itself depends. This is the sense of restless striving, never satisfied, like Sisyphus always rolling a

stone up-hill only to have it roll back, like Tantalus trying to drink from water that ever recedes. We are conscious of this striving as pain. Pleasure is negative in the world of the will, the mere temporary cessation of pain in striving to allay a thirst which always returns. We are conscious of this striving under the form of time. But it is deeper than time, deeper than consciousness. It is in its essence unconscious, undivided and identical everywhere. It is undetermined and capricious.

This would lead to complete transformism; and biologically Schopenhauer is a transformist. But Schopenhauer is also a Platonist. The will is conceived as objectifying itself in certain eternal types. The lowest stage of objectification is that of inorganic matter with its characteristic struggle and restlessness. Not satisfied at this stage, the will objectifies itself as life—plant and animal. It rises by a series of transformations or objectifications to the third and highest of its stages, that of the human brain, which has intelligence as its function. Extravagant of the individual and only regardful of the species, this restless, unconscious will thus objectifies itself in an ascending series of eternal Ideas, until it becomes conscious of the futility and vanity of the whole process in man. Intelligence is not a cause, it is a function. It is a paralytic carried on the shoulders of a blind giant. The will-to-live, through its unconscious genius, constructs the brain, as it constructs the stomach and other organs, as instrumental for the realization of its urge. But unwittingly it has prepared for its own undoing, for in the light of consciousness it reveals its own monstrosity. It sees its restless, unsatiate striving as the root of all evil.

The ego must now seek to emancipate itself from its throbbing desire to live; and this it can do only by negating desire—by becoming disinterested. This it can accomplish momentarily in the disinterested search for knowledge and in the disinterested contemplation of the Platonic Idea as realized in art. But for permanent peace the desire to live and to propagate life must be extinguished; and this can be done only through self-denial, asceticism. We must learn to recognize that the finite self is an illusion, the one will appearing as many in the diversity of space

and time. When we join in common sympathy to alleviate the pain of others, but especially when we have attained a will-less and self-less Nirvana, we shall see that the road we have traveled has no existence. Change, multiplicity, space and time are all illusions. Evolution belongs to the world of appearance, not to the world of reality. And the appearance itself is a disease which cannot be accounted for. So we find that Schopenhauer's elaborate account of evolution is "much ado about nothing."

Von Hartmann elaborates the idea of the Unconscious with scientific training much superior to that of Schopenhauer. He is especially suggestive in his treatment of the subconscious in our psychological life. He recognizes more explicitly than Schopenhauer the implied dualism of Will and Idea in the Unconscious, throughout the stages of evolution, from the lowest to the highest. For Von Hartmann, as for Schopenhauer, evolution is not the end. Salvation consists in the emancipation of the Idea from the will. In this moment of disillusionment, the will evidently withdraws like a bashful maiden, to use a figure from the Sankhya philosophy. Let us hope it withdraws in shame, considering the orgy it has wrought. For universal cosmic salvation, there must come the universal cosmic negation of the will; but he makes clear that this must come in a temporal act, for otherwise it would be an endless process. The goal of the world process is the universal emancipation from the misery of volition; and we should devote ourselves to this goal. It seems that in so doing we are making the end of the Unconscious, our conscious end. Von Hartmann must know this through some sort of clairvoyance, which is the typical vision of the Unconscious. But though Von Hartmann's treatment is suggestive, the explaining of evolution and everything else by the Unconscious does not seem to explain anything. Knowledge of the Absolute, as Von Hartmann recognizes, is just knowledge which we arrive at empirically and which we project into the Absolute. The Unconscious does not know. If we must carry on a dialectic with the Absolute, let him come out into the light, as Hegel's Absolute as least pretends to do. This should be easy since the Absolute is what his maker wants him to be. We should

like to know how the unholy union of Will and Idea happened in the Unconscious, for from this union, with its variety of offspring of all stages, came all the struggle and misery of the world. Can there ever be a consummation when all the illegitimate cosmic offspring will join in renouncing the will which leads to pain and so produce universal peace? And when the renunciation has taken place, what is left of the whole evolutionary process except a passing illusion?

Some Laymen's Preformation Theories

It is difficult to find among professional philosophers a theory of evolution which holds to eternal structure and also recognizes real evolution. For such a union we may have to go to the layman rather than the professional philosopher. The layman cannot be expected to be consistent, but he is close to experience. According to *Our Unseen Guest,* which purports to be a revelation from the spirit world, "the universe created and creates itself. There is no *deus ex machina,* no extramundane God."[65] But God is not only the "Consciousness of the Whole" as it now is, but God can also be translated as "the Supreme Degree of Consciousness."[66] Space, time and pluralism are recognized as well as oneness. "Those relationships that are evolutional you know temporally, those that result from the pluralistic character of the whole you know spatially."

The author naïvely calls his theory "monistic pluralism" which seems contradictory enough. But everything is a real part of a whole, the reality of which is consciousness. The potentialities of everything are in this consciousness—from the atom up through all the "degrees." "There was no creation; there is but the development of higher and higher degrees of consciousness."[67] And every degree has its quality and its quantity. The quality of the individual is the soul of that degree with its potentiality. The quantity is the realization of that quality whether it be electricity or the genius of John Keats. The individual counts: "Just as surely as a man can aid in the consummation of material forces, so, too, can he aid in the consummation of spiritual victories."[68] The development of de-

grees with their quality and quantity is continued on the yonder side. In fact this is more important than the hither side.

Following the lead of *The Unseen Guest*, Stewart Edward White, a novelist, has developed its philosophy in his own way with much greater scientific equipment and literary skill. (It is rather difficult to get literature out of a ouija-board. Beside the mechanical difficulties, there is the individuality of the medium who is the spokesman.) For Mr. White, too, the all inclusive reality is Consciousness. In this all the essences exist: "In the all-pervasive cosmic consciousness, . . . complete treeness, . . . complete anything, up to the point of present development of consciousness, exist everywhere in suspension, as it were, ready to precipitate when the conditions of their being are fulfilled." The development of a tree rather than a dog is due to the fact that the conditions for trees are stronger at that point than the conditions for dogs. "The conditions must be assembled by consciousness. They are not a matter of chance. But the Individual Idea is the most essential part of the conditions. In every degree of Consciousness, there is the invariable presence of the Idea or Intention. . . . The conditioning central dynamism expresses itself in the material." Whether in a chemical compound, a plant, an animal or a human being, "the raw material takes its shape in conformity to an idea of thing, or an intention." The chemist discovers the Idea: "The Idea is there, embodying itself in the fashion that expresses itself best."[69] Any manifestation whatever is both preceded by and governed by the idea of that manifestation. "The babyness was inherent in the germ-cell, the butterfly-ness in the chrysalis. In other words, the differing quality of consciousness in each case made the difference in the forms of life. . . . It is this rather than a literal Platonic 'prototype' which determines species and kinds. Nevertheless we must beware of conceiving these qualities apart from the consciousness of which they are attributes or phases."[70] In every instance the conditions must be assembled for the manifestation of law. The special form which an Idea such as treeness takes depends upon its environment. But there may be other environments. "Indeed philo-

sophically one can go farther and predicate that all qualities of consciousness exist everywhere.''[71]

It is a different matter to predicate that all created things are the embodiments of consciousness from saying that they possess consciousness on their own account. ''At some moment self-ness began. The moment might be defined as that in which a thing begins to recognize itself as Me and not somebody or something else, and to fight with what facilities and weapons it may possess to remain Me.''[72] This might have begun with the microscopic amoeba. ''As soon as he gets that far along, he has his job. And that job is in essentials no different from your job and my job. It is simply to *practice*. What more have we to do. We are all learning to steer by our own compass: to be completely Me.''[73] The nature of the ultimate Consciousness Mr. White, with due modesty, does not profess to know. We extend our limits in space and time and appropriate what we need. ''And always behind is the ultimate Inunderstandable which we cannot touch. We name it Spirit, the thing Beyond, the Ultimate, God. And having placed our marker at the utmost point of the usable, we turn back to till our chosen field.''[74]

The most daring and thorough-going attempt to interpret evolution from the point of view of preformation is that of America's greatest poet, the cosmic poet par excellence, Walt Whitman.

I have heard what the talkers were talking, the talk of the beginning or the end,
There never was any more inception than there is now,
Nor any more youth or age than there is now,
And never will be any more perfection than there is now,
Nor any more heaven or hell than there is now,

For Walt Whitman, pantheism is the religion of absolute democracy. ''And nothing, not God, is greater to one than one's self.'' And that is because the self is divine. Every human being is for him potentially divine and he loves them all passionately —the despised and rejected as well as those well-favored.

Swiftly arose and spread around me the peace and knowledge that pass all the argument of the earth,
And I know that the hand of God is the promise of my own,
And I know that the spirit of God is the brother of my own,

And that all men ever born are also my brothers, and the women my sisters and lovers,
And that a kelson of the creation is love.

With the same passion, he loves nature as divine. Everything is pregnant with meaning.

All truths wait in all things,
They neither hasten their own delivery nor resist it,
They do not need the obstetric forceps of the surgeon.
The insignificant is to me as big as any.[75]

Walt Whitman has an exuberant faith in evolution as the unfoldment of the germ of divinity. There is no flaw in this unfoldment. What we call evil is part of the plot of a perfect consummation and is therefore good.

In this broad earth of ours,
Amid the measureless grossness and the slag,
Enclosed and safe within its central heart,
Nestles the seed perfection. . . .
For it the mystic evolution,
Not the right only justified, what we call evil also justified.[76]

The germ of the self, and of everything, is present from the beginning in an indefinitely remote past.

Rise after rise bow the phantoms behind me,
Afar down I see the first huge Nothing, I know I was even there,
I waited unseen and always, and through the lethargic mist,
And took my time, and took no hurt from the fetid carbon.
Long I was hugg'd close—long and long.
Immense have been the preparations for me,
Faithful and friendly the arms that have helped me.
Cycles ferried my cradle, rowing and rowing like cheerful boatmen,
For room to me stars kept aside in their own rings,
They sent influences to look after what was to hold me,
Before I was born out of my mother generations guided me,
My embryo has never been torpid, nothing could overlay it.
For it the nebula cohered to an orb,
The long slow strata piled to rest it on,
Vast vegetables gave it sustenance,
Monstrous sauroids transported it in their mouths and carried it with care.
All forces have been steadily employ'd to complete and delight me,
Now on this spot I stand with robust soul.[77]

He can say then

I am an acme of things accomplish'd, and I am an encloser of things to be.[77]

The whole history of the self is taken up into the present—

I find I incorporate gneiss, coal, long-threaded moss, fruits, grains, esculent roots,

And am stuccoed with quadrupeds and birds all over,
And have distanced what is behind for good reasons,
But call anything back when I desire it."

The whole of this ceaseless evolution is according to a determinate plan.

There is no stoppage, and never can be stoppage,
If I, you, and the worlds, and all beneath or
upon their surfaces, were this moment
reduced to a pallid float, it would
not avail in the long run,
We should surely bring up where we now stand,
And surely go as much farther, and then farther and farther."

But the outcome is assured forever, be the ages as long as you like.

My rendezvous is appointed, it is certain,
The Lord will be there and wait till I come
on perfect terms,
The great Camerado, the lover true for whom
I pine will be there."

The reason for Walt Whitman's optimistic faith that evolution cannot fail is that there is infinite time and space. Here is a nineteenth century philosopher who has not been corrupted by the subjectivity of Kant. He glories in the infinity of time and space. They are part of the plan.

A few quadrillions of eras, a few octillions of cubic leagues, do not hazard
the plan or make it impatient.
They are but parts, anything is but a part.
See ever so far, there is limitless space outside of that.
Count ever so much, there is limitless time around that."

He is not afraid of time and space. The soul is worth more than time and space.

I know I have the best of time and space and never
was measured and never will be measured."

But they are the roads we must travel to the goal.

Not I, not any one else can travel that road for you,
You must travel it for yourself."

The immensities of time and space exhilarate him. He glories in their opportunity.

Space and Time! Now I see it is true, what I guessed at,
What I guessed when I loaf'd on the grass,
What I guessed while I lay asleep alone in my bed,

And again as I walk'd the beach under the paling stars of the morning,
My ties and ballasts leave me, my elbows rest in sea-gaps,
I skirt sierras, my palms over continents,
I am afoot with my vision."

Walt Whitman sees time, history, as a significant perfect whole.

Here or hence forward it is all the same to me, I accept time absolutely.
It alone is without flaw, it alone rounds and completes all,
That mystic baffling wonder alone completes all."

The past and the future are alike important because they are parts of a whole. The past is not only the road we have traveled, but is in us and points to the future for its completion.

The past is the push of you, me, all precisely the same.
And what is yet untried and afterward is for you, me, all precisely the same.
I do not know what is untried and afterwards,
But I know it will in its turn prove sufficient, and cannot fail. . .
Because all I see and know I believe to have its main purport in what will yet be supplied.

. . . . . .

Every condition promulges not only itself, it promulges what grows after and out of itself.
And the dark hush promulges as much as any.

. . . . . .

All goes onward and outward, nothing collapses,
And to die is different from what any one supposed, and luckier."

The future is the great adventure, but Walt Whitman has no doubt of its goodness.

The past and present wilt—I have filled them, emptied them,
And proceed to fill my next fold in the future.

. . . . . .

What is known I strip away,
I launch all men and women forward with me into the Unknown.
The clock indicates the moment—but what does eternity indicate?

. . . . . .

Births have brought us richness and variety.
And other births will bring us richness and variety.
I do not call one greater and one smaller,
That which fills its period and place is equal to any."
And I will show that there is no imperfection in the present and can be none in the future,
And I will show that whatever happens to anybody, it may be turn'd to beautiful results,
And I will show that nothing can happen more beautiful than death."

Death is the great adventure "toward the unknown region," but even there time and space remain.

Till when the ties loosen,
All but the ties eternal, Time and Space,
Nor darkness, gravitation, sense, nor any bounds bounding us.
Then we burst forth, we float,
In Time and Space, O soul, prepared for them,
Equal, equipt at last, (O joy! O fruit of all!) them to fulfill O soul."

What Walt Whitman wants to emphasize above all is that time and events are "compact with soul," that there is no object "nor particle of one but has reference to the soul."[78] That which we feel as the most intimate and real,

It is not chaos or death—it is form, union, plan—
it is eternal life—it is happiness.

The realization of perfection in time and space is his dream, his vision, his prayer:

Give me, O God, to sing that thought,
Give me, give him or her I love this quenchless faith,
In Thy ensemble, whatever else withheld withhold not from us,
Belief in plan of Thee enclosed in Time and Space,
Health, peace, salvation universal.
Is it a dream?
Nay but the lack of it the dream,
And failing it life's lore and wealth a dream,
And all the world a dream.

What impresses me in America's great poet is his catholic sense of reality.

I accept reality and dare not question it,
Materialism first and last imbuing.
. . . . . .
I help myself to material and immaterial,
No guard can shut me off, no law prevent me."

Because of his sense of reality he accepts time and space and expands his soul in them. The greatest reality of all, the enveloping reality, is God:

I hear and behold God in every object, yet understand God not in the least."

And he believes absolutely in the worth of his own soul and everybody's soul:

Nor do I understand who there can be more wonderful than myself."

That Walt Whitman has created a great cosmic philosophy there can be no doubt. He is to me far more pregnant with meaning than the systematic philosophers who have followed

the tradition of Kant. One inhales drafts of energy and fragrance in God's open spaces and finds oneself linked with the whole of history. Not being a technical philosopher, he has not defined his great intuitions of Space and Time and Self and God. Perhaps if he had tried to do so he would have evaporated their reality as the speculative philosophers have done. But while the philosopher must begin with sound intuitions, he must also try to comprehend them. We must try to understand space and time and matter and show their reality in the whole. We must try to show the relation of God to nature and the self. We shall find more pluralism than Walt Whitman's compact world allows, and the problem of evil will accordingly loom more difficult. While Walt Whitman believes in a plot in things as the fundamental article of his faith, he fails, in his abounding optimism, to recognize that there is tragedy in the universe as well as comedy—tragedy at least for the individual whatever it may be for the whole. But in Walt Whitman we have found the most vital statement of the preformationist view, though so stated it is in danger of dropping into optimistic fatalism, as it has done in the spiritualistic monism of the schools. We must later examine the meaning of evolution and creation in a pluralistic world—such as the world we live in. And we shall need the buoyant life inspired by Walt Whitman to descend into the matter-of-fact world—partly compact, but in parts also disjointed.

Preformism as an attitude of mind has prevailed in Western thought until recent times. This is true not only of the great systems of philosophy since Parmenides, but it is equally true of science.[79] Mechanism, with its prefigured constellations, has dominated physics until recently and still dominates biology. The merit of preformism is that it emphasizes structure in nature and thus makes it amenable to thought. It also possesses the lure of simplicity. Everything is conceived as part of one woof which we need only unravel. But it has bought its simplicity at too high a price. It has failed to take time seriously. It has done its business with a spatialized time, and has elimi-

nated real time with its novelty and contingency. The real world is too pluralistic and indeterminate to be fitted into one rigid scheme. It is far more interesting and more tragic than that.

History has not just one outcome, predetermined from eternity. It has many possible outcomes, according to the part which the participants play. It is a world of possible creativeness and possible failure. We must find our way by trial and error. And we ourselves determine in part the outcome. There is indeed structure in reality. Else were the world a mere babel of confusion, with no meaning. But there is also a great deal of indeterminacy; and it is for the participants to discover the viable structure. This is not just handed us in an intuitive fashion. Nor is it plainly outlined in the facts of experience, like a Venus in the marble, as Leibniz thought. We must create hypotheses and try them out in experience, as we must create the Venus from the marble. The world in which we live is not a safe guaranteed world, but a highly venturesome, thrilling and dangerous world in which we must create our rôles, with the genius that is vouchsafed us. The human spirit wants not only security, but opportunity to attain, with the risk that goes with it. A world of mere repetition of set themes would be as tiresome as an old wife's tale. If themes are repeated—as they must be to some extent if we are to have science and art—they are repeated with endless variations.

CITATIONS ON CHAPTERS 1 AND 2

1. See *Roman Stoicism,* E. V. Arnold, 1910; *Stoicism,* St. George Stock, London, 1908; *The Stoic Philosophy,* Gilbert Murray, 1915; *Stoic and Epicurean,* R. D. Hicks, 1910; *Philo Judaeus,* J. Drummond, 1888; *Stoics and Sceptics,* Edwyn Bevan, 1913.
2. *Stoic and Epicurean,* R. D. Hicks, 1910, p. 23.
3. *Roman Stoicism,* E. V. Arnold, 1911, p. 89.
4. From final chorus of *Hellas.*
5. Quoted by R. D. Hicks, *op. cit.,* pp. 37, 38.
6. R. D. Hicks, *op. cit.,* p. 57.
7. *Ibid.,* p. 57.
8. *Ibid.,* p. 104.
9. *Stoics and Sceptics,* 1913.
10. *The Stoic Philosophy,* Gilbert Murray, 1915, pp. 56, 57.
11. *Erigena,* 683 B; Bett, p. 35.
12. *Erigena,* 879 A, B; Bett, pp. 82, 83.
13. *La Philosophie Au Moyen Age,* Etienne Gilson, p. 19.
14. *Erigena,* 869; Bett, p. 84.
15. *Erigena,* 654 B; Bett, p. 34.
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17. Bett, *op. cit.,* p. 33.
18. Bett, p. 50.
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30. *Ibid.,* p. 371.
31. *Ibid.,* pp. 370, 371.
32. *Process and Reality,* 1929. See esp. Pt. V, Ch. II.
33. *Ibid.,* p. 521.
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46. Quoted by Carr, *op. cit.,* pp. 102, 103.
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58. *Ibid.*, last paragraph.
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60. *Ibid.*, Sec. 376.
61. *Ibid.*, Sec. 249.
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66. *Ibid.*, p. 313.
67. *Ibid.*, p. 221.
68. *Ibid.*, p. 315.
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70. *Ibid.*, p. 90.
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72. *Ibid.*, p. 110.
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74. *Ibid.*, p. 104.
75. The preceding quotations are from *Song of Myself*.
76. *Song of the Universal.*
77. *Song of Myself.*
78. Starting from *Paumonok.*
79. See Chapter 3, Emergence and Structure in Science.

PART II

EMERGENCE

Chapter 3

EMERGENCE

The Cleavage in Theory

We live in a world of flux, transition, transformation. "The bird is on the wing." A glory, a tragedy, has passed away. Things have not always been what they are. Everything has a past. It bears the marks of the road it has traveled. Man, the animals, the plants, the earth, the moon, the sun, the myriad stars that twinkle in the silence of the immensities of space all carry the tracery of the past; they must be understood in the light of their history. The world as we perceive it is on the go, wherever it may be going. The southern negro who, to the question: "Where are you going, Sam?" replied in his homely way: "I done been where I was going," was going in spite of himself. The great processes of nature were carrying him on even then to an unknown future. By a series of metamorphoses we have arrived at our present state, and the end is not yet. The present has reference not only to the past whence we came but also to the future whither we are going. One form changes into another and nothing is fixed, except some peoples' fixed ideas. This transformation in its most general sense is what we have come to call evolution. Evolution merely means history. Everything we perceive—stars, earth, life, man—has a history. There is no dispute about the facts of nature, so far as they can be said to be facts. Science is merely a description of the course of things, an attempt to predict the behaviour of things in the future from their behaviour in the past. The question is about interpretation, the meaning of it all—metaphysics. For metaphysics is merely our human attempt to decipher the meaning of things. As by making imaginative pictures (even though the pictures must be mathematical), the physicist tries to understand appearances in the small and the astronomer, in the large, so by making pictures the philosopher tries to understand this

moving kaleidoscopic world as a whole—though they may seem the mere pictures of a dream.

The fundamental cleavage in human interpretations of reality is that between the view which holds that there is structure in reality, that there is plot in the passing show of experience, that the world in which we live is some sort of whole; and the view that reality is a mere collection of things, in which the parts are mechanically determined. In the language of Shakespeare, the upholder of the former view might say:

> I this infer,
> That many things, having full reference
> To one consent, may work contrariously:
> As many arrows, loosed several ways,
> Come to one mark; as many ways meet in one town;
> As many fresh streams meet in one salt sea;
> As many lines close in the dial's centre;
> So may a thousand actions, once afoot,
> End in one purpose, and be all well-borne
> Without defeat.[1]

The other point of view is that evolution is a string of episodes without plot, that reality has no objective structure, that what we call structure is itself the result of "the accidental collocations of atoms" or whatever may be the ultimate constituents of things. In the poetic imagery of Shakespeare's Macbeth:

> Life . . . is a tale
> Told by an idiot, full of sound and fury,
> Signifying nothing.

This philosophy has been spoken of by the idealists, from Plato down, as a philosophy of chance, which means that there is no guiding field of any sort; things just happen, and the law of natural selection, i.e. the ability to survive, furnishes the only regulative principle. Chance in this sense does not necessarily mean that anything may happen; it need not mean a denial of causality or of probability. But the ultimate elements—atoms, electrons or whatever they may be—are neutral so far as any order is concerned. The elements, like the blocks of a children's game, are just thrown together, and some may happen by mechanical causes to stand together and make a house or some other figure, with more or less durability, but the process of nature is not partial, it cares nothing for the result, and undoes

it with the same indifference that it built it. The probability of chance may be illustrated by the mathematical expectancy in throwing neutral dice, which is a different probability from that of throwing loaded dice. The question is whether reality is neutral with regard to the occurrence of events or guides them in conformity with a structure of its own. Is the future loaded? The philosophy of chance and the philosophy of structure are both based on faiths, postulates. Which is the more congenial to our imagination in interpreting the facts as we know them? If neither can be proved theoretically, which is the more inspiring to human living?

In a broad sense we shall give the name, materialistic emergence, to the type of interpretation which denies objective structure and control and which holds that everything happens by the blind combinations of the elements of matter or energy, i.e. without any guidance. This sort of emergence includes the whole of evolution from its simplest beginnings to the highest beings which we know or can conceive. We shall use the term creation to indicate emergence with guidance. I should like to use the term creative evolution in contrast with emergent evolution but "creative evolution" and "emergent evolution" have often been used interchangeably and the term creative evolution has lost its descriptive value.

In Plato for the first time we have the conscious recognition of the cleavage between an idealistic interpretation of nature and a naturalistic materialism. The theory of materialistic emergence, viz. that the advance of nature is due to the external combination of material elements without any guidance whatsoever, was familiar to Plato. The conception of elements is crude enough but one can easily substitute the terminology of modern science. The fundamental principle is the same:—"They mean to say that fire and water, and earth and air, all exist by nature and chance, and not by art, and that as to the bodies which come next in order—earth and sun, and moon, and stars—they are created by the help of these inanimate existences, and that they are severally moved by chance and some inherent influence according to certain affinities of hot with cold, or of dry

with moist, or of soft with hard, and other chance admixtures of opposites which have united of necessity, and that on this manner the whole heaven has been created, and all that is in the heaven, including animals and all plants, and that all the seasons come from these elements, not by the action of mind, as they say, or of any god, or from art, but as I was saying, by nature and chance only; and that art sprang up after these and out of them, mortal and of mortal birth, and produced in play certain images and very partial imitations of the truth, having an affinity to one another, such as music and painting create and their companion arts. . . . And that the principles of justice have no existence at all in nature, but that mankind are always disputing about them and altering them, . . . that the highest right is might.''[2] This for Plato is the logic of materialism whether anybody could be found who would be willing to sit for the picture or not.

Emergence in Lucretius

For the beginnings of the doctrine of materialistic emergence, we must go back to the Greek atomists, Leucippus and Democritus. We have the merest fragments of their theory. But we know that they assumed two types of reality, matter and space. Since matter had already usurped the name of ''being'' in the philosophy of Parmenides, Leucippus called space non-being. Matter consists of particles which differ merely in shape, size and arrangement. These particles are not perceptible, but must be assumed by reason to account for the world of the senses. The particles or atoms move ''hither and thither'' in space (as Plato puts it in the *Timaeus*) and in doing so get entangled and form whirls which account for the distribution of matter. The whole process takes place by necessity, i.e. it is strictly mechanical. Out of the combinations of these atoms and their action upon our organism the whole world of sense qualities emerges, and all the variety of things as we perceive them. By ''custom'' we attribute these qualities to nature, but ''in truth,'' we are told by Democritus, ''there are atoms and the void.''

In order to understand the later development of atomism we

must (strange as it may seem) take a squint at the cosmology of Aristotle, for Aristotle's criticism of atomism was destined to have important consequences. Aristotle's account of other systems of thought is not very satisfactory from a historical point of view, for he always evaluates other systems in terms of his own sophisticated language. Aristotle finds fault with the atomists, and the Greek naturalists generally, for assuming motion as a property of reality. He thinks they ought to show the cause of motion; and the only ultimate cause of motion for Aristotle is the Unmoved Mover. Whether such an assumption is easier to understand than the assumption of motion is another matter. Aristotle means by motion directive motion—something the atomists denied. He cannot appreciate the epoch-making discovery of space by the atomists, for what he means by space is place. By place he means "the innermost motionless boundary of what contains."[3] Place is a sort of geometrical vessel. It is "coincident with the thing, for boundaries are coincident with the bounded. If then a body has another body outside it and containing it, it is in place, and if not, not." Events occur in a place and in a moment of time. He believes in a physical geometry of such a kind that everything has a natural place to which it tends. Aristotle's space prescribes to things their course, as does the space of Einstein. There is an absolute up and down in space. The earth is set immovably at the center of the whole,[4] and the rotating heavens form the rim of Aristotle's world. It is a finite spherical world; and outside the shell of the world there can be no matter, no place, no time, no motion. Whatever is outside "is of such a nature as not to occupy any place, nor does time age it; nor is there any change in any of the things which lie beyond the outermost motion; they continue their duration unalterable and unmodified, living the best and most self-sufficient of lives."[5] Since what is outside is perfect, it is unchangeable and infinite in power and the source of motion to all the world.

But the important thing here is that Aristotle's world has an absolute up and down which is determined by its structure. Whatever moves down toward the center is absolutely heavy

and whatever moves upward to the heavens is absolutely light. Earth, therefore, is absolutely heavy, and fire is absolutely light. What is relatively heavy or relatively light is determined by the speed of its motion. Of two portions of fire, "the upward movement of the greater is quicker than that of the less, just as the downward movement of a mass of gold or lead, or of any other body endowed with weight, is quicker in proportion to its size."[6] This was the doctrine against which Galileo had to do battle in the seventeenth century A.D. It was with such a picture of the world in his mind that Aristotle criticized the haphazard infinite world of the atomists. The latter triumphed with the mechanistic conception of modern science, but the indications are that Aristotle's conception of geometrical control may have a revival. There is also the revival of Aristotle's identification of space with geometrical place. It was Epicurus' merit to distinguish between the place in which a thing is and space as room in which to move.

But what does Aristotle have to do with the history of ancient atomism? We must remember that Aristotle comes between Democritus and Epicurus. Whether or not the latter as a youth of eighteen attended lectures at the Lyceum in the year when Aristotle had exiled himself to Chalcis, at any rate his philosophy shows in numerous ways the influence of Aristotle. Epicurus adopted from Aristotle the idea of an absolute up and down. Since all the atoms have absolute weight, according to Epicurus, therefore all must fall down, down, down in empty space. In some way, however, he arrived at the momentous intuition that all bodies fall with the same velocity in empty space. But this idea led to serious consequences for his theory. For if all atoms fall with the same speed in empty space, how could they ever meet? It was necessary for Epicurus to endow his atoms with the freedom to turn a little from the perpendicular, in order that they might collide and so produce a whirl here and there, which might start the process of world-building. From the point of view of scientific theory it seems a retrograde movement, first to make the erroneous assumption of an absolute up and down in space and then to try to

remedy the mistake by endowing the atoms with free will. But Epicurus, after all, was stationed upon the earth and judged motion from his frame of reference, and the important thing proved to be that bodies fall to the earth with the same velocity. Even his indeterminism does not seem so ridiculous now as it once seemed.

Epicurus had little interest in science. His cosmology was merely a foil for his ethical system; and his hurried, careless and voluminous way of writing would have smothered effectively his influence upon later ages had he not succeeded in kindling the enthusiasm of a young Roman poet in the century before the Christian era. Lucretius, like Shakespeare, by virtue of his love of nature and his keenness of observation, was a better naturalist than the scientists of his time. His great scientific poem, *Concerning the Nature of Things,* records many wise suggestions, based upon empirical observations; and it was through the intriguing beauty of this epic that ancient atomism was preserved through the hostile Middle Ages and could bring about the revival of atomism in the Renaissance. Newton held Lucretius in high esteem and generously recognized his anticipations. Lucretius followed Epicurus* in holding that all bodies fall with the same velocity in empty space, but he showed his empirical bent by watching the "rain-drops." The reason that bodies do not appear to fall equally is explained by the resistance of matter in space. Lighter bodies are forced upwards by the pressure of heavier bodies, and so air and fire rise upwards; but in empty space there is no such interference, and therefore bodies fall equally. Newton gives Lucretius credit for having anticipated Galileo, and it was certainly Lucretius' poem which connected with modern science. Lucretius has been criticized for attributing weight to the atoms, but if we make the earth the frame of reference, as in fact he did, weight amounts with him, as with Democritus, merely to the amount of matter

* Further knowledge of Epicurus shows how faithful Lucretius was to his master. I shall not try to show what suggestions are peculiar to Lucretius, but his immortal poem furnishes the most complete and convenient statement of ancient atomism. Moreover, in his empirical insights Lucretius far outstrips the general theory which he took over.

and might be stated in modern terminology as mass or inertia.

Lucretius explains the indeterminacy of the atoms by the analogy of human choice. In action initiated from within the individual, "the beginning of motion is born from the heart, and the action first commences in the will of the mind and next is transmitted through the whole body and frame." Quite different is the case when we move on propelled by a stroke inflicted by the strong might and strong compulsion of another, for then it is quite clear that "the whole body moves and is hurried on against our inclination, until the will has reined it in throughout the limbs."[7] This conception of initiative, Lucretius transfers in a lesser degree to the atoms. This has been a scandal to mechanistic determinism which consistently denies initiative to human beings as well as to atoms. But recent science has shown that the smallest constituents, the electrons, seem to have a range of "choice" and that determinism is probably statistical, resulting from regarding the conduct of numerous entities *en masse* and not from the point of view of the individual. Lucretius, too, takes a mechanistic view of the behaviour of matter *en masse*.

Lucretius argues that since space is infinite, matter must be infinite, else matter would be dissipated and the collisions of matter and the compounding of things would come to an end. On the contrary, Lucretius holds that the cosmic process has always gone on as it does now. There is increase or decrease in any one part, but the available matter is constant. Change takes place by exchange. It is merely a question of distribution. The sum of things is constant. "The sum of things is ever renewed and mortals live by a reciprocal dependence. Some nations wax, others wane, and in a brief space the races of living things are changed and like runners hand over the lamp of life"[8]—a marvelous intuition; and if Lucretius had developed it on a universal scale, it would have led to the theory of evolution by cosmic interaction. Lucretius does apply his general theory of quantitative waxing and waning to all the material worlds in space. Contrary to a general superstition (which was perpetuated by Neoplatonism and scholasticism) that the sun continues

to pour out light without diminishing, Lucretius holds the modern conception that the sun is continually losing matter by the emission of light, like "nightly lights which belong to the earth." Hence "we must believe that the sun, moon and stars emit light from fresh and ever fresh supplies rising up, and always lose every previous discharge of flames; that you may not haply believe that these flourish indestructible."[9] He concludes from the many improvements and inventions of recent date that this world is new, which at any rate applies to man.

While the atoms, "like grains of corn," have different shapes and sizes (as shown in light passing through horn) Lucretius does not follow his predecessors in holding that the atoms have "all shapes and sizes." On a theory of chance you would suppose, as Leucippus and Democritus did, that the atoms might have any shape or size, but Lucretius holds for empirical reasons that "the number of shapes is finite. If this were not so, then it would follow that some seeds must be of infinite bulk of body."[10] But this "cannot be proved." There is no evidence of atoms of infinite bulk. If there were an infinite variety of atoms there would be an infinite variety of things and values. In that case it would not be possible, Lucretius thinks, to standardize qualities and values as we do. "For something ever would arise more surpassing than the rest" or worse than the rest. "Now since these things are not so, but a fixed limit has been assigned to things which bounds their sum on each side, you must admit that matter also has a finite number of different shapes." The boundaries of value might be fixed by human nature, but Lucretius was right in his intuition that there could be no description or prediction of the natures of things in a world of infinite variety. There could be no chemistry. Lucretius is further led on empirical grounds to lay down the postulate that "the things produced differ by finite degrees."[11] There is a finite maximum and a finite minimum with variations between these limits. "From summer fires to chill frosts a definite path is traced out and in like manner is again travelled back; for every degree of cold and heat and intermediate warmths lie between these extremes, filling up in suc-

cession the sum." In a world of infinite variation we could not expect regular finite cycles. Lucretius implies not merely that the limits are finite but that the variations between are finite. This is common sense. Lucretius is of course equally innocent of the infinitesimal calculus and of the quantum theory. He further holds that, while the varieties of atoms are finite, each variety is infinite in number. This follows from his theory that matter is infinite and the same throughout infinite space, and that therefore the same integrations can take place everywhere in space. This was congenial to his imagination, but he had no spectroscope to show that matter is the same everywhere.

The modifications of the atomic theory, indicated by Lucretius, are far-reaching. Since the discovery of radioactivity we have been struck by his suggestion that the atoms are themselves made up of minima. "First-beginnings therefore are of solid singleness, massed together and cohering closely by means of least parts, not compounded out of union of those parts, but, rather, strong in everlasting singleness."[12] This conception of the atom was adopted by Newton. It is a remarkable imaginative anticipation. His suggestions that the variety of atoms is finite and that the variations in nature are within finite limits are based upon genuine empirical grounds and mark a radical change from the conception of a world of riotous variety, assumed by the early atomists.

Lucretius still holds that nature "is seen to do all things spontaneously of herself without the meddling of the gods."[13] Nature is self-sufficient. "This world has been made by nature, just as the seeds of things have chanced spontaneously to clash, after being brought together in manifold wise, without purpose, without foresight, without result; and at last have filtered through such seeds as, suddenly thrown together, were fitted to become on each occasion the rudiments of great things, of earth, sea, and heaven, and the race of living things."[14] Assuming the uniformity of nature, he thinks "that there are elsewhere other combinations of matter like to this which ether holds in its greedy grasp."

He further assumes a natural tendency to repetition in na-

ture. "When much matter is at hand, when room is there and there is no thing, no cause to hinder, things sure enough must go on and be completed."[15] Hence "you must admit that in other parts of space there are other earths and various races of men and kinds of wild beasts." Nature repeats itself in kinds or classes. "A thing always belongs to some class and there are many other things in the same kind."[16] This can be observed in living things. "In this sort has been begotten the mountain-ranging race of wild beasts, in this sort the breed of men, in this sort too the mute shoals of scaly creatures and all bodies of fowls." The same principle may be extended to the earth and other bodies in space which are of a kind and must be expected to produce similar results as those of which we see samples on our earth. That things fall into classes, Lucretius concludes from the evidence of experience, but of course he is influenced by the Platonic tradition.

If Lucretius has banished the gods from nature, he has, as so many naturalists after him, apotheosized law. Things do not happen just any way, but "after a fixed law." Nature is not merely a jumble of elements. Arrangement, organization must be taken into account as well as events, and the former controls events. "We are not to suppose that all things can be joined together in all ways; for then you would see prodigies produced on all hands. . . . It is plain, however, that nothing of the sort is done, since we see that all things produced from fixed seeds and a fixed mother can in growing preserve the marks of their kind. This you are to know must take place after a fixed law. For the particles suitable for each thing from all kinds of food when inside the body pass into the frame and, joining on, produce the appropriate motions; but on the other hand we see nature throw out on the earth those that are alien, and many things fly out of the body impelled by blows: those I mean which have not been able to join on to any part nor when inside to feel in unison with and adopt the vital motions. But lest you haply suppose that living things alone are bound by these conditions, such a law keeps all things within their limits."[17] There is a whole-control which selects and rejects according to its or-

ganization. Here again Lucretius has the good sense to follow empirical evidence and not his metaphysical theory.

In very much the same way as Aristotle, Lucretius states the law, according to which things in growing preserve the marks of their kind. Since a human being is the result of two kinds of seed, the mother's and the father's, children resemble their parents. We find either the dominance of one or the other or a blend of the characteristics of the two kinds of seed. Sex is not contributed "by the fixed seed of one or other parent," any more than our faces or limbs. "Whichever parent that which is produced more resembles, of that parent it has more than an equal share; as you may equally observe, whether it is a male child or female birth." Lucretius also takes account of recessive characters. "Sometimes too the children may spring up like their grandfathers and often resemble the forms of their grandfathers' fathers, because the parents often keep concealed in their bodies many first-beginnings mixed in many ways, which, first proceeding from the original stock, one father hands down to the next father, and then from these Venus produces forms after a manifold chance and repeats not only the features, but the voices and hair of their forefathers."[18] Lucretius' account of heredity suggests Mendelian characters, but it has the advantage that it does not deal with abstractions but with material complexes.

Lucretius takes pains to dispose of final causes. "You should desire with all your might to shun the weakness, with a lively apprehension to avoid the mistake of supposing that the bright lights of the eyes were made in order that we might see"[19] or legs in order to walk or hands "to discharge the needful duties of life." To explain an organ by its use is to "put effect for cause, since nothing was born in the body that we might use it, but that which is born begets for itself a use." We do not have eyes in order to see or ears in order to hear, but we see because we have eyes and hear because we have ears. "They could not therefore have grown for the purpose of being used." Evolution does not take place by design or purpose, though we have seen that it takes place in an orderly way. For the rest,

natural selection is ever operative to restrict the field. The earth has changed and established new conditions of production and survival. "Time changes the nature of the whole world and the earth passes out of one condition into another: what once it could, it can bear no more; in order to be able to bear what before it did not bear." In an earlier stage the earth produced many monsters, "but all in vain, since nature set a ban on their increase and they could not reach the coveted flower of age nor find food nor be united in marriage. . . . And many races of living things must then have died out and been unable to beget and continue their breed."[20] Those survived which possessed some special advantage such as strength or craftiness, courage or speed. That the nature of things may have been made for us "by a divine power" is incredible to Lucretius on account of "the defects"[21] with which nature is "encumbered." Most of the earth is uninhabitable. "Of nearly two thirds burning heat and the constant fall of frost robs mortals." What is left for tillage requires unceasing labor and then excessive heat or sudden rains and cold frosts often cut off the fruits of man's labor. Why all the noxious animals? "Why stalks abroad untimely death?" The gods exist in blissful isolation from the drama of time. The world runs itself.

Everything except "the first beginnings," with their shape and size, emerges from the "restlessness" of nature. The things we deal with in nature are compounded things which have emerged from the composition and organization of simple things. The arrangement is of "vast importance," but the differences in the first beginnings cannot be ignored. The "vital sense" cannot be produced from stone. Life is begotten in the history of the earth, though we have to go back to the youth of the earth for the most favorable period of such productiveness. There is still spontaneous generation, as worms after rain show! All that is necessary is that the proper conditions should be present. For the variety of unlike things to be produced there must be a difference in constituents, "in the spaces between, the passages, the connexions, the weights, the blows, the clashings, the motions."[22] In this way all the so-called secondary

qualities are born or "emerge" as we should say. They are not in "the first beginnings." "Colours are begotten by a certain stroke of light" and vary with the conditions. "And since the pupil receives into it a kind of blow, when it is said to perceive a white colour, and then another, when it perceives black or any other colour, and since it is of no moment with what colour the things which you touch are provided, but rather with what sort of shape they are furnished, you are to know that first-beginnings have no need of colours, but give forth sensations of touch varying according to their various shapes."[23] The emergent qualities must be mechanically explained. "Whatever things we perceive to have sense, you must yet admit to be all composed of senseless first beginnings. . . . Nature changes all food into living bodies and engenders out of them all the senses of living creatures, much in the same way as she dissolves dry woods into flames and converts all things into fires."[24] Thus "the sensible is begotten out of senseless things." In this process "it is of great moment in what sort of arrangement the first-beginnings of things are severally placed and with what others they are mixed up, when they receive and impart motions."

Lucretius gives a clear and circumstantial account (though Plato had anticipated him in the *Timaeus*) of "how the image is seen beyond the mirror"—a phenomenon which has played a conspicuous part in recent realistic philosophy. He sees that such a phenomenon is a compound effect or due to "two airs." It is not important for this purpose that Lucretius adopts the naïve conception of Democritus that things shed thin images of themselves. What is relevant is that when we see our image in a mirror "the image which is conveyed from us reaches the mirror and then is reflected and comes back to our eyes, and drives on and rolls in front of it a second air and lets us see this before itself and for this reason it looks so far from the mirror. Wherefore again and again I repeat there is no cause to wonder why the images give back the reflexion from the surface of mirrors in the spot they do, since in both the given cases the result is produced by two airs."[25] The reversal of the image in the mirror so that "the right side of our body is seen in

mirrors to be on the left," is due to refraction, "since nature constrains all things, when they are carried back and recoil from things, to be given back at angles equal to those at which they are impinged."[26] The details must of course wait for the development of the science of optics.

There are a number of other wise suggestions in Lucretius which we can barely mention. He anticipated Weber's law of the threshold, viz. that the stimulus must reach a certain intensity before it can overcome the physiological inertia. He points out that there are often objects which we do not sense—"the adhesion of dust when it settles on our body," "a mist at night," "a spider's slender threads as they come against ūs," "each particular foot-print which gnats and the like stamp on our body," and concludes: "So very many first-beginnings must be stirred in us, before the seeds of the soul mixed up in our bodies feel that these have been disturbed, and by thumping, with such spaces between, can clash, unite and in turn recoil."[27] Among other suggestions he shows that interest is the basis of memory and that things which we have dwelt upon in the daytime come back as dreams, and they are responsible for some dreams.

Lucretius pays especial attention to the emergence of soul and mind. Mind is a name for the higher directive functions of soul such as understanding. Mind is a genuine part of the functioning organism: "First then I say that the mind which we often call the understanding, in which dwells the directing and governing principle of life, is no less part of the man, than hand and foot and eyes are parts of the whole living creature."[28] Mind is not just the "harmony" of the body, but an active controlling part of the organism. It is because he believes in the interaction of mind and body that he conceives of the mind as constituted of physical elements. The only action he can conceive is by contact. The mind must consist of physical atoms to act upon the atoms of the body. Science has only recently invented the concepts of energy and energy fields, and thus bridged the gap between the material and immaterial. But while Lucretius must think of mind as physical, he recognizes a qualita-

tive difference between psychic stuff and other stuff. Soul and mind are constituted by "seeds exceedingly round and exceedingly minute in order to be stirred and set in motion by a small moving power." These seeds have great velocity: "Nothing that is seen takes place with a velocity equal to that of the mind when it starts some suggestion and actually sets it agoing; the mind therefore is stirred with greater rapidity than any of the things whose nature stands out visible to sight."[29] Mind is localized in the heart as with Aristotle. "It has a fixed seat in the middle region of the breast; here throb fear and apprehension, about these spots dwell soothing joys; therefore here is the understanding or mind. All the rest of the soul disseminated through the whole body obeys and moves at the will and inclination of the mind."[30] When there is "no novel sensation," we do not feel the stirring of the rest of the body. "But when the mind is excited by some more vehement apprehension, we see the whole soul feel in unison through all the limbs, sweats and paleness spread over the whole body, the tongue falter, the voice die away, a mist cover the eyes, the ears ring, the limbs sink under one; in short we often see men drop down from terror of mind; so that anybody may easily perceive from this that the soul is closely united with the mind, and when it has been smitten by the influence of the mind, forthwith pushes and strikes the body."[31]

Lucretius marshals a great deal of evidence which he had amassed with "welcome toil" to show the integrity of mind and body. He recognizes his inability to show in detail how this integration is produced. But he thinks that "the first beginnings by their mutual motions are interlaced in such a way that none of them can be separated by itself, nor can the function of any one go on divided from the rest by any interval; but they are so to say the several powers of the body."[32] The "nameless power" which is "the very soul of the whole soul" unites with the heat and the air and "the unseen power of the spirit" to form "a single nature" and makes the body a living conscious thing. He associates heat with anger, spirit with fear, and air with calmness. These are responsible for

temperamental differences which education cannot destroy, yet they "are so exceedingly slight that there is nothing to hinder us from living a life worthy of the gods."

He tries to prove the interdependence of mind and body by all the lines of evidence. He shows how the attention to the exciting idea produces its physical results. Genetically, mind and body are seen to develop and decay together. "The mind is begotten along with the body and grows up together with it and becomes old along with it. For even as children go about with a tottering and weakly body, so slender sagacity of mind follows along with it; then when their life has reached the maturity of confirmed strength, the judgment too is greater and the power of mind more developed. Afterwards when the body has been shattered by the mastering might of time and the frame has drooped, with its forces dulled, then the intellect halts, the tongue dotes, the mind gives way, all faculties fail and are found wanting at the same time."[33] His conclusion is that as mind and body grow up together and decay together, mind can have no existence separate from the body. A blow on the head may make us unconscious. Diseases of the body often affect the mind so that it "wanders and goes astray" or sinks into lethargy. Wine effects the mind as well as the body. Again, when the disease is cured or the intoxication is over, mind assumes its normal functioning. "Again the quickened powers of body and mind by their partnership enjoy health and life." Mind and body must follow the same law of integration and dissolution. If the soul is immortal and enters the body at conception, why do we not remember? "If the power of the mind has been so completely changed, that all remembrance of past things is lost, that methinks differs not widely from death."[34] He is amused at the absurdity of souls standing by "the unions of Venus," waiting their turn. How are they to decide whose turn it is? Shall they agree that it is the first comer? How account for the difference in quality and capacities on this basis? He overlooks the assumption of the advocates of metempsychosis that the souls, differing in character and genius, select the physical union which is appropriate. But he is right that they

had failed to define soul and had failed to show how the soul could be an agent in nature. So long as action by impact was regarded as the only action in nature, the soul must be conceived as physical atoms of some sort, as Lucretius conceived it. Lucretius further shows that the senses must belong to the body. The soul without the body could have no senses. If the soul could see, he thinks a man ought to be able to see through the holes of his head when his eyes have been removed!

Since there can be no continuity of existence after death, there is no reason to fear what will happen after death. When a man moans over the fact that wild beasts may tear his body after death, he fancies himself standing by as a spectator. But he will not be there. The same atoms may get together again. But there will be no memory and therefore no continuity with any previous existence. "Thus one thing will never cease to arise out of another, and life is granted to none in fee-simple, to all in usufruct. Think too how the bygone antiquity of everlasting time before our birth was nothing to us. Nature therefore holds this up to us as a mirror of the time yet to come after our death. Is there aught in this that looks appalling, aught that wears an aspect of gloom? Is it not more untroubled than any sleep?" Thus "immortal death" triumphs over "mortal life."

It will be clear now why I have selected the greatest of scientific poets as the outstanding historical representative of "materialistic emergence." We must admire the candour and nobility of the man and marvel at his poetic insight. Like Shakespeare, he is a good naturalist whenever he deals with things within the range of his first-hand observation. Where Lucretius deals with astronomy he is less felicitous, partly because of the tradition on which he leans—that of Epicurus—partly because of the technical character of the field which makes his suggestions seem naïve. He is not sure whether the sun goes round the earth or is born anew from fire and mist each day. Either seemed to agree with his experience. Contrast with this his description of the phenomenon of lightning, in which he records his observations with remarkable accuracy. We must recognize in Lucretius a great empirical emergentist. He is all

the more to be admired because he bases his particular hypotheses upon experience rather than attempting to deduce them from his general hypothesis. It does not follow from his general hypothesis of the spontaneous collision of an infinite aggregate of atoms in the void—without any guidance or control whatsoever—that there must be a finite number of types of atoms, that changes vary by finite degrees, that there are "fixed laws" of arrangement, that things fall into kinds or classes, that there is a natural tendency to the recurrence of a whole when conditions permit. These are all empirical generalizations showing marvelous concrete insight, but not consistent with his general theory of a neutral combination of infinite bits of stuff. It is because he gives us an empirical account of nature that his poetic insight is able to give us the remarkable anticipations which we have in part pointed out. These empirical generalizations would, I think, require a different imaginative framework than that which he inherited from Democritus and Epicurus. The poet in Lucretius was wiser than the speculative philosopher. Perhaps it is because he is a poet that he has the genuine scientific spirit.

Emergence in Stoicism

The later Stoics, according to Plotinus, developed a theory of strict emergence, i.e. the "birth" of the higher from the lower by "chance," i.e. without any guidance. Plotinus calls them materialists. That is surprising to us since we think of them as pantheists. They seem to have spoken of the ultimate substance as either matter or spirit. When we grasp their conception of matter we can see that it is irrelevant which they call it. In developing their theory they were eclectic: they borrowed from the atomists, from Plato and from Aristotle, as well as from Heraclitus. The ultimate substance has parts which enter into combinations. But the ultimate matter is without qualities, like Plato's matter, and it is also spoken of as a substratum and as potential in the language of Aristotle. But these terms take on new meaning in the theory of the Stoics. To Plotinus, the Stoics have turned the world upside down, for

they derive the higher from the lower, the actual from the potential, which is the very opposite of the Platonic tradition. No wonder Plotinus has no patience with them. But we can at least be sure that they were pure empiricists in their account of evolution, as well as in their account of knowledge. From the ill-natured hints of Plotinus we can reconstruct the outlines of their cosmology, as Plotinus understood it.

Since the Stoics believed that the cosmos is a series of cycles in one history, everything melting in the universal fire and starting over again, only to repeat the previous history, it is logical that they should have developed the theory of emergence, whether they did or not. They speak of the later as being "born" out of the earlier. Everything in the last analysis is born out of matter. It is, in the language of Plotinus, the result of the "accidental combinations of matter." From Plotinus' point of view the Stoics taught "that something happens without a cause," or by "chance." Yet he also tells us that they were strict determinists: "Every posterior fact is the consequence of an anterior one." For the Stoics, matter is the ultimate reality. Everything else is the result of "modifications of matter." This primal matter is without qualities. Qualities are "qualified matter."[35] They arise from the combinations of matter. The same is true of categories and essences—of everything except the primal matter. "Life is an accidental modification of matter."[36] The soul is a certain kind of organism, which in turn is a modification of matter. When we have the consciousness of sensations such as pain, there is "relay transmission"; "the sense impression is felt first by the animal spirit that is in the finger, and then transmitted to the neighboring part, and so on till it reaches the directing part."[37] This would involve, according to Plotinus, an infinite series of sensations. Everything is explained naturalistically. "Under this hypothesis the primary nature of the soul would have been dependent on the concourse of exterior circumstances. The Stoics, therefore, posit as principle that which is less perfect (the soul), and trace it to a still less perfect earlier thing called habit (or form of inorganic things). Intelligence, therefore, is posited in the last rank since

it is alleged to be born of the soul, while, on the contrary, the first rank should be assigned to intelligence, the second to the soul, the third to nature, and following natural order we should consider that which is less perfect as the posterior element. In this system, the divinity, by the mere fact of his possessing intelligence, is posterior and begotten, possessing only an accidental intelligence. The result would, therefore, be that there was neither soul, nor intelligence, nor divinity; for never can that which is potential pass to the condition of actualization, without the prior existence of some actualized principle.''[38]

We can see why it makes no difference whether the Stoics call the ultimate element matter or spirit. The characteristics we know are in any case due to combinations of the primary element. Matter, life, soul, intelligence are emergents from these combinations. The compounds, however, which we call matter or life or soul or intelligence must, according to the Stoics, possess a ''special characteristic'' or ''manner of being.'' Such qualifications are meaningless, according to Plotinus, unless they imply ''an active nature superior to that of bodies.''[39] Plotinus wrongly interprets the Aristotelian conception of the soul (as the form of the body), to mean function of the body. But he tells us that Alexander of Aphrodisias ''insists that to produce life these elements must be mingled in a certain manner.''[40] This, according to Plotinus, implies ''the existence of a principle which produces order, and which could be the cause of mixture, . . . and that should alone deserve being considered as soul.'' For Plotinus ''the most irrational theory of all is that an aggregation of molecules should produce life, that elements without intelligence should produce intelligence.''[41]

Evidently the emergence theory was very much alive in the third century A.D.; and whether we can trust Plotinus' interpretation of the Stoics or not we should be thankful to him for having preserved to posterity this conception, however distorted by his own theory. Plotinus' version gives Stoicism a new position in the history of thought. Stoicism (or Plotinus) must be credited with having created the first thorough-going theory of emergence. For while S. Alexander's theory[42] is more sophis-

ticated with its background of modern science, he is not thorough-going. He assumes a *nisus* which does not grow out of his fundamental matrix, space-time. But even the Stoicism of Plotinus' version implies more than it consciously postulates. If everything is born out of the accidental combinations of matter, why should the process necessarily eventuate in divinity? Why not in the devil? The Stoicism of Plotinus, like modern emergentism, has confused sequence with causality, description with explanation.

In their religious moods at any rate, the Stoics forgot their empiricism and held with Shakespeare's Hamlet

> There is a destiny which guides our ends,
> Rough-hew them as we will.

In such moralizing preachers as Epictetus and Marcus Aurelius what is emphasized is the providence of an all-inclusive divinity of which our lives and everything are expressions. Whatever happens is the will of this inclusive Zeus or Reason; and it is for the individual to resign himself to what is, and worship in piety "the soul of many a soul," which is manifest in us and in everything. But this pantheistic Stoicism is not concerned with the evolution of Zeus; its pietistic phrases can easily be translated into naturalistic terms; and the order of reason becomes materialistic determinism, for after all Zeus is just an apotheosis of what happens.

Stoicism in its logical development, if we take Plotinus' version seriously, shows that a pantheistic monism which takes a thorough-going genetic view of reality as a one-way process—one history or evolution—where the more complex grows out of simpler antecedents, is indistinguishable from evolutionary materialism. It is merely a question of language. The series of appearances is the same, and the final result—things as they are—is the same. Whether we call the beginning spirit or matter is indifferent, so long as we confine ourselves to mere description. In any case, what we ordinarily mean by spirit—the creative activity which shows itself in science, art, morality, and religion—is an end-term and not present in the beginnings of the process.

Emergence in Dialectical Materialism

The transition from pantheism to materialism is strikingly illustrated in the nineteenth century by Ludwig Feuerbach. "The evolution of Feuerbach is that of a Hegelian to materialism—not of an orthodox Hegelian, indeed—an evolution which from a definite point makes a complete breach with the idealistic system of his predecessor. With irresistible force he brings himself to the view that the Hegelian idea of the existence of the absolute idea before the world, the pre-existence of the logical categories before the universe came into being, is nothing else than the fantastical survival of the belief in an extra-mundane creator; that the material, sensible, actual world to which we ourselves belong, is the only reality, and that our consciousness and thought, however supernatural they may seem, are only evidences of a material bodily organ, the brain. Matter is not a product of mind, but mind the product of matter. This is of course pure materialism."[48] This is the interpretation of Feuerbach's development by Frederick Engels.

But Feuerbach did not pass directly from Hegelianism to materialism. He first swung to the extreme left, rejecting the transcendental absolute and developing a strict pantheism in which the self-consciousness of man becomes the only absolute. This philosophy was expressed in Feuerbach's *Essence of Christianity*—a momentous book, because it became the inspiration of one of the most important of historical movements, materialistic socialism, led by Karl Marx and Frederick Engels. *The Essence of Christianity* emphasizes the pure immanence of divinity. "The yearning of man after something above himself is nothing else than the longing after the perfect type of his nature, the yearning to be free from himself, i.e. from the limits and defects of his individuality. Individuality is the self-conditioning, the self-limitation of the species. Thus man has cognizance of nothing beyond the nature of humanity, but to the individual man this nature presents itself under the form of an individual man. Thus, for example, the child sees the nature of man above itself in the form of all its parents, the pupil in the form of his tutor. But all feelings which man experiences towards a superior

man, nay in general, all moral feelings which man has towards man, are of a religious nature. *Man feels* nothing towards God which he does not feel towards man. *Homo homini deus est.* Man is god to man."[44]

Thus the Hegelian absolute is thrown overboard as a theological superstition. "The *absolute* to man is his own nature." While for St. Augustine, "God is nearer, more related to us, than sensible, corporeal things," for Feuerbach, "consciousness of God is self-consciousness, knowledge of God is self-knowledge. By his God thou knowest the man, and by the man his God; the two are identical. Whatever is God to a man, that is his heart and soul, and conversely. God is the manifested inward nature, the expressed self of a man—religion the solemn unveiling of a man's hidden treasures, the unveiling of his intimate thoughts, the open confession of his love-secrets."[45] Feuerbach rejects the dialectical method and substitutes the empirical method; theology becomes anthropology. "The secret of theology is anthropology."[46] This is a logical consequence of his theory that "the absolute mind is the so-called finite subjective mind." Feuerbach sets himself to reinterpret and transform the old theology in terms of his religion of humanity. Creation-out-of-nothing, "omnipotence, is nothing else than subjectivity exempting itself from all objective conditions and limitations and consecrating this exemption as the highest power and reality: nothing else than the ability to posit everything real as unreal —everything conceivable as possible: nothing else than the power of the imagination, or of the will as identical with the imagination, the power of self-will."[47] Here we have the anticipation of Wundt's "omnipotence of thought" and the Freudian wish.

The language and content of the *Essence of Christianity* is still that of idealism. But young and keen thinkers, like Engels and Karl Marx, who were restive under the dominance of the Hegelian philosophy, were quick to see the implications. The message came as a liberating breath to them. The gulf which Hegel had left between nature and mind was destroyed. The effect is well expressed by Engels: "Then came Feuerbach's

Wesen des Christentums. With one blow it cut the contradiction, in that it placed materialism on the throne again without any circumlocution. Nature exists independently of philosophies. It is the foundation upon which we, ourselves products of nature, are built. Outside man and nature nothing exists, and the higher beings which our religious phantasies have created are only the fantastic reflections of our individuality. The cord was broken, the system was scattered and destroyed, the contradiction, since it existed only in imagination, was solved."[48] Hegel had treated nature in a stepmotherly fashion. It was the absolute in its "otherness," its "estrangement," its "fall." There was no bridge between the system of Hegel and the mechanical otherness of despised nature. But if the absolute is the creation of man and man is the product of nature, the dualism disappears. Feuerbach soon saw that his radical pantheism was merely an inverted materialism, and substituted the language of eighteenth century materialism for the language of idealism. His religious interest, however, survived, and he tried to interpret the development of history as the development of religion. This was rejected by the Marxians who emphasized economic motives as fundamental in human progress. They also rejected the sentimental humanitarianism of Feuerbach for historical socialism which aims at the industrial emancipation of man. Feuerbach like Moses led the way to the promised land but could not enter.

Feuerbach, later, came to feel the limitations of the eighteenth century materialism which he had adopted: "Materialism is for me the foundation of the building of the being and knowledge of man, but it is not for me what it is for the physiologists in the narrow sense, as Moleschott for example, since necessarily from their standpoint it is the building itself. Backwards, I am in accord with the materialists but not forwards." Engels criticizes Feuerbach for not being able to "overcome ordinary philosophical prejudice, prejudice not against the thing, but against the name materialism." But in principle, Engels agrees with Feuerbach. The rigid mechanical materialism of the eighteenth century must be left behind. For mechanical materialism, he would substitute what Broad calls "emergent materialism." Material-

ism, too, must develop to meet the new facts. But Engels would keep the name. "Feuerbach held quite correctly that scientific materialism is the foundation of the building of human knowledge but it is not the building itself. For we live not in nature but in human society, and this has its theory of development and its science no less than nature. It was necessary, therefore, to bring the science of society, that is the so-called historical and philosophical sciences into harmony with the materialistic foundations and to rebuild upon them. This was not granted to Feuerbach."[49]

One limitation of eighteenth century materialism was that it recognized only the mechanical type of relation. This was due to the fact that "at that time, of all the natural sciences, mechanics, and indeed, only the mechanics of the celestial and terrestrial fixed bodies, the mechanics of gravity in short, had reached any definite conclusions." But the development of chemistry and biology make the mechanical type of explanation inadequate. "The exclusive application of the measure of mechanics to processes which are of chemical and organic nature and by which, it is true, the laws of mechanics are also manifested, but are pushed into the background by other higher laws, this application is the cause of the peculiar, but, considering the times, unavoidable, narrowmindedness of the French materialists."[50] The necessity of recognizing new categories, appropriate to the emergent situations, becomes even more obvious in dealing with society.

"The second special limitation of this materialism lies in its incapacity to represent the universe as a process, as one form of matter assumed in the course of evolutionary development."[51] Eighteenth century materialism lacked the historical comprehension of nature. This is true of Hegel also. Indeed Hegel moves within eighteenth century mechanism. He fails to take time seriously. (If he had done so, he could not have claimed that his philosophy was true for all time.) "According to him, nature is the mere outward form of the Idea, capable of no progress as regards time, but merely of an extension of its manifoldness of space, so that it displays all the stages of development com-

prised in it at one and the same time together, and is condemned to a repetition of the same processes. And this absurdity of a progress in space but outside of time—the fundamental condition of all progress—Hegel loads upon nature, just at the very time when geology, embryology, the physiology of plants and animals, and inorganic chemistry, were being built up, and when above all genial prophesies of the later evolution theory appeared at the very threshold of these new sciences (e.g. Goethe and Lamarck), but the system so required it, and the method, for love of the system, had to prove untrue to itself."[52] The Marxians (unlike Feuerbach) were sympathetic to the dialectic method, while they rejected the system. It is significant that in Soviet Russia, where Marxian materialism has become the official philosophy, it is still called "dialectical materialism."

But dialectic is given a strictly evolutionistic interpretation by Engels and Marx. The conflict of Hegelian categories becomes a class struggle in which the economic motive becomes dominant. Dialectic means a progressive historical development. "Every step is necessary and useful for the time and circumstances to which it owes its origin, but it becomes weak and without justification under the newer and higher conditions which develop little by little in its own womb; it must give way to the higher form, which in turn comes to decay and defeat. As the bourgeoisie through the greater industry, competition, and the world market destroyed the practical value of all stable and anciently honored institutions, so this dialectic philosophy destroyed all theories of absolute truth, and of an absolute state of humanity corresponding with them. In face of it, nothing final, absolute or sacred exists, it assigns mortality indiscriminately, and nothing can exist before it save the unbroken process of coming into existence and passing away, the endless passing from the lower to the higher, the mere reflection of which in the brain of the thinker itself it is itself. It has indeed also a conservative side, it recognizes the suitability of a given condition of knowledge and society for its time and conditions, but only so far. The conservatism of this philosophical view is rela-

tive, its revolutionary character is absolute, the only absolute it allows to stand.''[53]

What remains of the idealistic philosophy is the faith in unlimited progress and the universal laws of progress. There is everywhere the evolution from the simple to the complex. The three great discoveries of the nineteenth century—the discovery of the conservation of energy, the discovery of the cell, the discovery of the evolution of higher forms from lower—''have emphasized the interdependence of the processes of nature.'' If science to the end of the eighteenth century ''was chiefly a collecting of knowledge, the science of actual things, so is science in our day pre-eminently an arranging of knowledge, the science of changes, of the origin and progress of things and the mutual conviction which binds these changes in nature into one great whole.''[54]

The emergent materialism of Engels recognizes the reality and importance of ideal forces. It has been the fashion to ascribe everything noble to idealism and everything base to materialism. But ideal aims are facts on any theory. ''The realities of the outer world impress themselves upon the brain of man, reflect themselves there, as feelings, thoughts, impulses, volitions, in short, as ideal tendencies, and in this form become ideal forces.''[55] If following ideal tendencies and admitting the influence of ideal forces make a man an idealist, there are no materialists according to Engels. Furthermore Engels maintains that ''the conviction that humanity, at least at present, as a whole, progresses, has absolutely nothing to do with the antagonism between materialism and idealism.'' The French materialists of the eighteenth century were as fanatical in their belief in progress as the deists. In other words, social idealism may be joined with metaphysical materialism, and no one can deny that Engels and Marx were social idealists. It is one of the ironies of history that nineteenth century idealism as exemplified by Hegel should have been the bulwark of autocracy and social privilege, while materialism was welcomed as a gospel of liberation. But it was not the first time that supernaturalism had been confused with an apotheosis of the past. If ''dialecti-

cal socialism'' remains true to the spirit of historical development, it may find that its present categories are inadequate to describe the new developments of science and social evolution. The old materialism has already become meaningless. And the Marxian faith in progress and in definite stages of progress is but a thinly disguised idealism. The danger is of course that it will prove untrue to the dialectic of history, and then, according to its own logic, it must be superseded.

The account which Engels gives of evolutionary materialism may be taken as representing materialistic emergence of to-day. Engels had learned from Hegel that reality at any stage must be described in categories appropriate to that stage. The mechanical or billiard ball conception of the eighteenth century still survives in text-books on philosophy, but it has no relevance to science to-day. It lingered on through the nineteenth century when scientists stopped to rationalize the procedure in science and was responsible for the clear-cut and rigid determinism of scientists who turned philosophers. Such a rationalization we find expressed by Thomas Henry Huxley in 1869: ''If the fundamental proposition of evolution is true, that the entire world, living and not living, is the result of the mutual interaction, according to definite laws, of the forces possessed by the molecules of which the primitive nebulosity of the universe was composed, it is no less certain that the existing world lay, potentially, in the cosmic vapour, and that a sufficient intellect could from a knowledge of the properties of the molecules of that vapour, have predicted, say the state of the Fauna of Great Britain in 1969, with as much certainty as one can what will happen to the vapour of the breath on a cold winter's day.'' This is of course rhetorical. ''What will happen to the breath on a cold winter's day'' seems obvious enough. But it is obvious from experience. The passing of the vapour from the gaseous to the liquid state and the further passing from the liquid to the solid state, with the corresponding change in properties, are discontinuities in nature which must be empirically ascertained and could not be deduced merely from atoms or molecules in motion. The old atomism, which prevailed until the end of the nineteenth cen-

tury, explained as far as it could, and when it came to an impasse either held out the hope of explanation or treated the facts as of no consequence. Democritus thus waves aside the secondary qualities. "By custom sweet is sweet, by custom bitter is bitter, by custom colour is colour but in truth there are atoms and the void." Properties revealed in sense perception are "obscure." Only the characteristics of the infra-sense situations at the level of atomic interactions are "clear" and real. Democritus, like Huxley, would have said that we can understand everything when we know the distribution of atoms at any moment. The mechanical rationalization of nature underwent little change from Democritus to Huxley. A mystery may have to be admitted now and then, like secondary qualities or like consciousness (in the case of Huxley), but this does not shake the confidence in the mechanical explanation. It was only with the new discoveries at the end of the nineteenth and the beginning of the twentieth century that the tidy mechanical explanation had to go.

To-day the mechanical hypothesis is a dead hypothesis. As R. D. Carmichael so well puts it: "It is absurd to speak of a mechanical explanation of life and thought when we have found ourselves in such difficulties that we no longer know what we should mean by a mechanical explanation of phenomena not involving life." The mechanical model has ceased to have any significance for science. The reason that philosophers like Broad still take it seriously is that they deal with the physics of Democritus. Contrast with the picture of Huxley that of A. S. Eddington: "It is now generally accepted that in the reconstruction of ideas required to remove the present discrepancy between classical and quantum laws, the quantum laws must form the basis. These grade into the classical laws when the quantum numbers are very large; and it is only then that the classical conception of the physical world—including space, time, electrons, force, etc.—has any application or meaning. In this reconstruction all the determinism is removed from the laws of physics; the apparent determinism is found to be merely high probability. The probability is high (amounting practically to

certainty) when averages of large numbers are considered; but in individual processes only moderate odds are concerned. The new quantum mechanics contains only laws which decide the odds; it apparently has no cognizance of any factors deciding what actually will happen. In the old conflict between free will and predestination, it has hitherto seemed that physics comes down heavily on the side of predestination. The quantum theory has entirely removed this bias. Whatever view we may take of free will on philosophical grounds we cannot appeal to physics against it. The latest picture of the atom contains no mark or factor to decide what *that* atom will do next (although it contains factors deciding the average conduct of a number of such atoms); and whilst further developments in the theory may possibly disclose such a mark, it is on the whole rather against the spirit of the modern conception to expect this."[56]

Recent Theories of Emergence

The gain in the recent discussion of evolutionary materialism has been in the more precise definition of the term emergence and what it implies. Broad has coined the name "materialistic emergence" for the current theory. The phrase is awkward, but it means that, from simpler material situations in nature, there arise more and more complex situations which possess characteristic qualities which cannot be reduced to those of the simpler situations. In his own words: "The characteristic behaviour of the whole could not, even in theory, be deduced from the most complete knowledge of the behaviour of its components, taken separately or in other combinations, and of their proportions and arrangements in this whole."[57] Materialistic emergence excludes the assumption of a non-material component such as an entelechy "which does not occur in inorganic matter or in bodies which were formerly alive but have now died."[58]

A. O. Lovejoy stresses the contrast between the theory of emergence and that of preformation, which assumes a supernatural guidance. He defines emergence as follows: " 'Emergence' (or 'epigenesis' which would be a much more appropriate word) may be taken loosely to signify any augmentative or

transmutative event, any process in which there appear effects that, in some one or more of several ways yet to be specified, fail to conform to the maxim that 'there cannot be in the consequent anything more than, or different in nature from, that which was in the antecedent.' "[59] This excludes a strictly mechanistic as well as a supernaturalistic account of evolution. Lovejoy distinguishes between "the theses of the possibility of general and the actuality of specific emergence." The theory of general emergence rejects absolutely all preformation theories, while specific emergence is consistent with some preformation theories. Lovejoy, like Broad, commits himself to the theory of general emergence but unlike Broad he does not commit himself to a specific theory of stuff, leaving it presumably for science to determine what is the ultimate physical stuff. He rejects what he calls the "retrotensive" theories which argue that the stuff of the simpler antecedents must be like that in the most complex developments and therefore assume an ultimate mind stuff out of which all things are formed. While that would bridge the gulf between material and mental, it is without basis in fact. He also rejects parallelistic theories, such as that of Lloyd Morgan, which assume a parallel development of mind and body from simpler antecedents of each kind. "Such a view appears to involve the general doctrine, at once confused and incredible, that physical events can have no causal relation to mental ones—which implies that sensations are not due to physical stimuli, and that if a man, after receiving a blow on the head, loses his memory, the blow is wholly irrelevant to the amnesia, which is causally explicable, if at all, solely by the thoughts he was thinking before he was hit."[60] This view he rightly regards as absurd.

Following the general lead of Lovejoy, we may now consider the types of emergents. Most fundamental is the evolutionary emergence of laws of combinations of matter and energy. Neither Broad nor Lovejoy defines what he means by "laws." If laws are human generalizations, they certainly emerge in the history of human effort to understand its world. They are at best tentative and approximate and subject to perpetual revision. The

human mind invents pictures of the ways of nature and selects those which are imaginatively satisfying and pragmatically serviceable. The trail of human nature is over all its work. There is no finality in the work of the human mind. New discoveries make reconstruction necessary. But if there is emergence in human theorizing about the ways of nature, must we also assume that these ways of nature emerge? Broad and Lovejoy evidently think of "law" in an objective sense as ways of combining *in* nature. They also think of the stuff which is combined as indifferent to the combinations. Lovejoy speaks of the emergence of laws in nature as "functional" in contrast with the emergence of qualities which he calls "existential" emergence. Broad thinks it is logically possible though not probable that there may be a general law of combination from which all special laws might be deduced. Both he and Lovejoy favor the emergence of laws, whatever that may mean. Their conception of permanent bits of stuff with merely "functional" relations seems to have no relevance to present science.

If the emergence of "laws" seems somewhat vague, we are assured that there is direct evidence that "qualities and classes of qualities" emerge. "The characteristic behaviour of Common Salt cannot be deduced from the most complete knowledge of the properties of Sodium in isolation; or of Chlorine in isolation; or of other compounds of Chlorine, such as Silver Chloride."[61] The only way we can ascertain the characteristics of chemical compounds is by studying "samples" of such compounds. Broad regards "primary qualities" as "physical emergents" but considers "secondary qualities", such as colour, taste, and smell as "transphysical emergents". I can see no reason for this discrimination against "secondary qualities". They are as truly physical emergents in the proper situations in nature as are the "primary qualities". The "secondary qualities", it is true, involve certain physiological conditions as part of the situation in nature. But so do all sense qualities. Again, particular entities or individual things, such as living things, psychological things, "having distinctive attributes (not merely configurational) of their own"[62] can be taken as emergents.

Finally, there may emerge "a greater quantity or number of instances, not explicable by transfer from outside the system, of any one or more types of prime entity common to both phases."[63]

On the theory of emergence, it is not necessary to suppose that all the characteristics of a selected level are emergent. Some characteristics it may share with lower levels. To quote Broad: "If we consider the properties of a given aggregate of high order we could then divide them into three classes: (1) Those which are characteristics of this order, in the sense that all the aggregates of the order possess them, that no aggregate of lower order does so, and that they cannot be deduced from the structure of the aggregate and the properties of its constituents by any law of composition which has manifested itself in lower orders. These might be called the 'ultimate characteristics' of the order. (Broad suggests that our failure to deduce these characteristics from the structure, properties and composition of the component orders may be due to our ignorance.) (2) Those which are characteristics of this order; but which could in theory be deduced from the structure of the aggregate, the properties of its constituents, and certain laws of composition which have manifested themselves in lower orders. These might be called 'reducible characteristics' of the order. (3) Properties which aggregates of this order share with those of lower orders. These might be called 'ordinally neutral properties'."[64] Many characteristics of the beating of the heart might be called "reducible characteristics". Broad calls the laws which connect properties of aggregates of different orders, "trans-ordinal laws", and the laws which connect properties of aggregates of the same order he calls "intra-ordinal laws". Thus the laws connecting the characteristics of living organisms would be intra-ordinal and the laws connecting the characteristics of inorganic things with living things might be called trans-ordinal. The law of the conservation of energy might be called an "ordinally neutral" characteristic.

I do not think that Broad can be called a strict emergentist for, in common with Lucretius and Engels, he assumes a nat-

ural tendency to complexity. "What must be assumed is not a special tendency of matter to fall into the kind of arrangement which has vital characteristics, but a general tendency for complexes of one order to combine with each other under suitable conditions to form complexes of the next order." Such a statement in the opinion of Broad makes the deistic hypothesis unnecessary though it is not inconsistent with it. We must in some instances recognize an internal teleology in nature. "The system is teleological provided it acts as if it were designed for a purpose,"[65] as in the case of organisms. This is far from recognizing an external teleology such as we find in artificial machines. But the assumption of "a general tendency" is after all but a thin substitute for deism.

Another reason why Broad cannot perhaps be regarded as a strict emergentist is the gulf which he makes between that which is mental and that which is non-mental. He feels strongly that the attempt to extend mechanical explanation to mental characteristics is absurd. Certain phenomena of "persistence", as evidenced to him in "psychical research", have also influenced him toward the assumption that another element, still physical, viz. a psyche, must be added to the elements of chemistry. This psyche combines with other material factors to make the life of mind. It persists after death for some time at any rate and he suggests that it may float about in cosmic space indefinitely, ready to combine with a material body under suitable conditions. He calls this theory the "compound theory of materialistic emergence": "The essential point of it is that mentality is an emergent characteristic of a *compound* composed of a living brain and nervous system and of something else which is capable of existing for some time after the death of the body and of entering into temporary combination with the brain and nervous system of certain peculiarly constituted human beings called 'mediums.' This something else I called a 'Psychic Factor.' "[66] He suggests that further evidence may show conclusively (as some now think is the case) that there is true "survival" of personality and not just "persistence." "In that case we might be forced to look with more favor on

dualistic theories which make mind a differentiating attribute.''[67] As I understand Lovejoy he holds to an absolute and not merely a relative distinction between mind and matter, i.e. he is a psycho-physical dualist.

It is interesting to note that the ancient atomists recognized the qualitative distinction between psychical and material characteristics and therefore assumed a special kind of atoms, very round and smooth and small and swift which, by combining with the grosser atoms, would constitute a psychological being. But their special element was assumed to be atomic, multiple and separable into its units. Possibly in view of such evidence as has proved convincing to Broad they might have been forced to modify their hypothesis so as to make possible a temporary ''persistence'' of the complex of psychical atoms, but they would doubtless have drawn the line at ''survival.'' On the evidence they had, they regarded the psychical functions as dependent upon the life of the organism. It is difficult to see how the assumption of a psychical element could simplify the problem of emergence. If you once admit general emergence, why shouldn't anything emerge? Emergence is after all only a descriptive name for what happens; and mind happens. In retrospect we may say that it happens in an orderly way, for we can, in part at any rate, follow the conditions. Emergentists generally are very liberal in their interpretation of emergence and attribute anything that appears, including mental pattern (Gestalt) to emergence. Social patterns also emerge.

Hybrid Emergence

We have above discussed emergent evolution in its strict regard. We cannot, however, pass by three British philosophers who have made notable contributions to evolution and who as naturalists take the emergent point of view—Herbert Spencer, Samuel Alexander and C. Lloyd Morgan. All three suggest the double aspect theory of Spinoza. In Spencer's and Morgan's interpretations, at any rate, evolution must be regarded as phenomenal, i.e. as looking at reality in ''naturalistic regard.'' Herbert Spencer is not on as intimate terms with the Absolute

as the German Romanticists, though the Unknowable is a rather thin disguise for the Absolute of the Romanticists. According to Spencer the ultimate concepts of science—space, time, matter, motion, force—lead to contradictions when we try to analyze them in thought. But this may be due to a false tradition, rather than to inherent contradictions. Knowledge, according to Spencer, moves in the world of the relational and conditioned, while reality is non-relational and unconditioned. There is thus a complete contrast, and East and West can never meet. How Spencer could know all this about the Unknowable seems astounding. But he seems to have learned it from Hamilton and Mansel, and they learned it from Kant. He thinks, however, he has a vague sense of the unconditioned in his consciousness of the sensational background of his thought. That rather degrades the Unconditioned, since it becomes merely the raw-material of our thought. But thought seems to be an imposition, and if we could know the Unknowable it would probably reveal a rich world of its own. It does manifest itself in the world of appearances as mind and matter, and it evidently stands for truth and beauty and right; and it is what we reverence in religion. If it were really unknowable, it would seem that there could be no reason why we should worship it, because we could not know whether it is God or devil.

In his description of the knowable—the world of appearances—Spencer is a naturalist. He might be called a materialistic emergentist* and a thorough-going one, for he regards everything as the result of the "Law of the Continuous Redistribution of Matter and Motion." But we must remember that this law belongs to the world of phenomena. He attempted a general formula for the whole evolutionary process: "Evolution is an integration of matter and a concomitant dissipation of motion, during which the matter passes from an indefinite incoherent homogeneity to a definite coherent heterogeneity, and during which the retained motion undergoes a parallel transforma-

* Herbert Spencer used the term emergence in Vol. I of his *Autobiography* in his review of his *Principles of Psychology*. Emergence in a technical sense seems to have been used first by George Henry Lewes.

tion." This formula he illustrates in all the domains of experience from the evolution of stars out of nebulae to the evolution of human society out of the horde. To do justice to Spencer we should remember that the formula is intended as descriptive and not as metaphysical. He took the second law of thermodynamics, the law of degradation of energy, seriously. There is loss of available motion throughout the process. This it would seem should make the cosmic process a finite process, since the loss is finite and very considerable in proportion to the energy which is actually effective in doing the work of integration. In the second and later editions of his *First Principles of Philosophy,* he recognizes that evolution means dissolution as well as integration. In later editions, as Schiller has pointed out, Spencer suggests the notion of world-cycles: "This process of evolution is due to 'the instability of the homogeneous,' the 'multiplication of effects' and their 'segregation,' continuing until it ceases in complete 'equilibration.' Sooner or later, however, the reverse process of 'dissolution,' with its absorption of motion and disintegration, which indeed has always been going on to some extent, must prevail, and these oscillations of the cosmic process will continue without end."[68] But this is viewing reality in phenomenal regard. The real ground of the process must be sought in Spencer's conception of the Unknowable. "But one truth must grow ever clearer—the truth that there is an Inscrutable Existence everywhere manifested, to which he (the man of science) can neither find nor conceive either beginning or end. Amid the mysteries which become the more mysterious the more they are thought about, there will remain the one absolute certainty, that he is ever in presence of an Infinite and Eternal energy, from which all things proceed."[69]

Spencer was certainly courageous in applying his formula to the whole process of apparent evolution. He accounts not only for the origin of life but also for the origin of consciousness, as the motion of matter to the more definite, coherent and heterogeneous. Sensations are generated from a common unit, a nerve-shock, and vary in quality with the rapidity of nerve-shocks. All feelings result from the varying integration

of this fundamental unit. The more complicated processes of consciousness are described as the integration of the simple feelings into various levels—primary, secondary, tertiary. These come to correspond, either by the inheritance of acquired characters or by individual experience, to the external environment and enable us to adjust ourselves to our world.

Spencer's philosophy came like a refreshing breath of air after the insulated speculation of the inner life. His formula was especially fascinating and inspiring to scientists, until they became narrow specialists and ceased to concern themselves about the universe in general, while philosophy dropped back for a while into romantic idealism which could be pursued without the knowledge of anything and was comforting to man's vanity. It is flattering to the stupid ass, who calls himself *Homo Sapiens,* to regard himself as the organ of the Absolute and in a sense the Absolute himself. But Spencer's formula is too generic and vague to help empirical science; and it leaves everything in the air when you try to make a metaphysics of it, which Spencer did not do. He was content to the end in the worship of the Unknowable.

Samuel Alexander's *Space, Time and Deity* is another notable instance, in British philosophy, of the recognition of emergence. Alexander is apparently dualistic. Space-time, with Alexander, takes the place of body-mind—time being the soul of space and space being the body of time, at various levels. The whole process is guided by a *nisus* which takes the place of Spinoza's substance. From the point of view of the wholeness of the process, Alexander's theory seems to be preformistic. God is the whole drive of the process, and every stage of the process must be explained in terms of the structure of the preceding stage back to the ultimate matrix of space-time, which is the ground of all that emerges. But from the point of view of the successive stages we have emergence—each stage having characteristics of its own. The next stage (which is in the process of being born) in this emergent development is deity to the preceding stages. Since I have had occasion to refer to Alexander's work at various places in this book and have devoted some space-time to

it in *Cosmic Evolution*,[68] I do not think it necessary to give a fuller summary of it in this place.

I find it difficult to place Lloyd Morgan's interpretation of evolution. He calls his theory "emergent evolution,"[69] but this is just a screen for spiritualistic monism. His theory, however, has closer kinship to Spinoza than to the psychological monism of the German romanticists. The whole process of evolution has for him a dual aspect—a material aspect and a psychological aspect. These aspects are parallel. Every material aspect has its concomitant psychological aspect, and the two vary together. But we must distinguish the view of evolution in naturalistic regard, which is the view of science, from the view of evolution in spiritual regard which is given by philosophy and religion. "Within any integral system, the instances that constitute its stuff as existent are 'here or there,' 'now and then'; but the substantial unity of its plan, as subsistent, is free from all such restrictions, spatial or temporal. This does not imply dualistic independence of the existent and subsistent, but their monistic interdependence within one realm of nature."[70] He rules out "dualism or pluralism of agents."[71] His definition of substance is not that of the natural sciences. He distinguishes between substance and stuff. Substance means the "go-together-ness" of items of stuff. Stuff is characterized by discreteness and multiplicity. Substance is an "indivisible unity." The meaning of substance is illustrated by the sentence: "He talked a lot of stuff but there really was no substance to it."[72] (A sentence which should make most preachers and professors of philosophy feel uncomfortable.) Substance would seem to be timeless in the sense that abstract meaning is timeless.

The whole process of evolution can be stated consistently in naturalistic terms. But Lloyd Morgan thinks that the naturalistic statement in no wise conflicts with a spiritual interpretation. "For naturalistic treatment, we loyally accept as existent (a) the go of events, and (b) such going together as we find. We accept also as subsistent (c) the determinate plan of their going together."[73] But the question of a comprehensive plan of evolution "lies beyond the purview of naturalistic interpreta-

tion."[74] His theory of emergence "attempts to formulate in broad outline the generic and still determinate law of advance in all natural entities."[75] From this point of view he gives us an admirable naturalistic description of evolution through its three stages—inorganic, organic, and mental. At each stage there is, not merely the recurrence of qualities found at a lower stage, but emergence of new qualities, characteristic of the new stage. His account of mental evolution shows his thorough mastery of the field. He distinguishes between "influence" (by which he means "physical influence") "which is germane to the life-story, and 'reference'" (by which he means "something purely mental as part of the mind story"). It is characteristic of reference that it "goes forth from the mind to that from which the body receives influence."[76] On the level of reference he distinguishes three stages.[77] The lowest is that of "non-cognitive reference" as in sensory acquaintance and reaction, which we find through most of the animal realm. Here the learning process is purely of the habit-forming type. There is no consciousness of meaning. At the second stage or "cognitive reference," there is "mental revival in the form of imagery." In expectant prevision of this type there is, not just items of imagery, but "substantial unity of meaning for current behavior." The thinking of children would come in this class. Here also would belong the sort of thought process revealed in the experiments by Köhler, Yerkes and others on Chimpanzees. This sort of meaning enables the individual to meet comparatively simple novel situations. After a certain amount of fumbling, there comes a moment of hesitation and then the discovery of certain relations among the objects of the environment, as when a Chimpanzee recognizes that by reconstructing the environment, for example by putting a chair on a table, etc., it can reach the desired bananas. But the process is concrete. There is no conscious hypothesis at this stage as in the third stage. The third stage involves "schematic plans and rehearsal," as in the projecting of a scientific hypothesis and trying it out mentally and physically. Here we can speak of conscious purpose. Concurrent with the process of reference

there is emergence of feeling or "enjoyment," which has a positive and negative dimension—pleasure and pain—, and which has its own levels of emergent qualities. With the highest level of reference there emerge the ideals of truth, goodness and beauty; and the religious attitude of reverence is supervenient upon these. This attitude has a "numinous" or mystical quality.

The statement of evolution is now complete in terms of naturalistic emergence. But the whole process, according to Lloyd Morgan, can also be viewed as a manifestation of Divine Purpose. The existence of divine purpose, like the existence of the external world, must be accepted "under acknowledgment." How shall we conceive this divine purpose? "The acknowledged activity in Divine Purpose is monistic to the core. It is that activity which is manifested in all action—including that which obtains in man—each according to its status. If it be said that such a monistic concept of activity, universally but differentially manifested throughout nature, belittles man and dethrones him from his high estate, I cannot agree. But I am more concerned to give to Divine Purpose its due—to enthrone God rather than dethrone man. If in some slight measure Divine Purpose be manifested in and through me, I am thankful and claim no more. ... My concern has hitherto been with integral *advance* in evolutionary process—that is with what I conceive to be a rational order of progress. Spiritual regard is now in focus. In that regard I believe that evolutionary advance and progress is a manifestation of Divine Purpose."[78]

But are we justified from a naturalistic point of view in accepting as self-evident "an integral advance" and "a rational order of progress" in the evolutionary process? That is precisely what materialistic emergence, dealing with the same facts, has denied. It holds that the whole series of emergent facts can be accounted for as "accidental concatenations of atoms". If we once accept "under acknowledgment" that the evolutionary process is "a rational order of progress", it is easy to translate our naturalistic advance into Divine Purpose. But we should like to know how this Divine Purpose is related to the evolutionary process. If Divine Purpose is wholly immanent

in the process, as Lloyd Morgan's *thoroughly monistic* theory requires, then (if we take time seriously) the Divine Purpose must itself emerge and this emergence remains to be accounted for. Pure pantheism is, as we have seen, indistinguishable from pure materialism if both are merely descriptions of the "go" of events. To speak of purpose at all in a monistic world seems a contradiction, for purposive realization certainly implies a discrepancy between what is and what ought to be. Otherwise realization is meaningless.

How are we going to meet the problem of evil on the basis of such a monistic spiritualism? For the materialist evil is a subjective point of view. Nature knows neither good nor evil. It merely goes its own irresponsible way. We call things evil when they conflict with our purposes. But what cares nature about our purposes? They are merely part of the sea-drift of purposeless matter. Lloyd Morgan, however, does acknowledge the presence of evil or sin. It is not part of the Divine Purpose. In Lloyd Morgan's excellent definition, "sin is not disintegration at a lower level that there may be further advance at a higher level. Sin is disintegration at a higher level that events may run their course at a lower level. It is purely retrogressive and in no valid sense contributory to progressive advance."[79] But how can such things be in a process which is through and through the manifestation of Divine Purpose and in which there is no dualism or pluralism of agents? Divine Purpose becomes merely an unsupported faith in Pope's aphorism: "Whatever is, is right."

If on the other hand Divine Purpose is supposed to exist in an eternal realm of its own as Spinoza's Substance or Hegel's Absolute, then the evolutionary process is not a temporal appearance of a timeless substance—that is as nonsensical as squaring the circle—but it is an illusion. It has no reality. But that is not consistent with Lloyd Morgan's honest treatment of reality in naturalistic regard. What is the use of throwing out dualism or pluralism through the front door of speculation, if we admit them through the back door in our final attitude to reality?

The recent emphasis on emergence is a wholesome protest against preformism in the philosophical thought of the past. The word emergence, as F. C. S. Schiller has pointed out,[80] cannot be said to be a fortunate choice for it contains the old ambiguity of the word evolution. Emergence may mean merely the coming to light of what was already present in germ; and then emergence is equivalent to preformation. What is meant by emergence in contemporary discussion is epigenesis, which emphasizes that there is real novelty in the process. The use of emergence in this sense seems to go back to George Henry Lewes, but has recently been revived by Lloyd Morgan. While this use of emergence is new, the idea which it emphasizes has been present, no doubt, since the beginnings of Western science. Thales must have recognized that his fundamental substance, water, occurs in a variety of forms with their distinct and novel characteristics. This is true, we know, of Anaximenes' air and Heraclitus' fire. For the early Greek naturalists, nature is in a process of transformation. Democritus recognized that his elements, the atoms, gave rise to a vast qualitative variety; and he had learned from Protagoras that the qualitative appearances of nature involve the human organism, though for Democritus the real world is that of atoms and the void, and this world is eternal and strictly determined. Epicurus and Lucretius introduced an indeterminate factor into the physical basis of the world, but science until recently has followed the lead of Democritus. Modern chemistry has long recognized that the characteristics of compounds cannot be deduced wholly from the characteristics of the elements which compose them. And, since Darwin, biologists have found that novelties in the way of variations or mutations intrude into the stream of life. Recently physics has come to the conclusion that the old conception of deterministic causality in nature is in fact a statistical result of dealing with large numbers, and has relevance only for the macroscopic world. It does not appear to be usable when we deal with the fine-grained transactions which are studied by quantum physics. Here we have to recognize indeterminacy and emergence.

Emergence has called attention to novelty in nature. We cannot read the universe from the past to the present and the future in the way the old determinism supposed. The present is not just implicit in the past, so that some archangel could read it off from the past, as the preformists have believed. "Behold I make all things new," says the genius of nature. But this does not mean that there is no repetition in nature. If this were so, there could be no science, since science is an attempt at prediction; and science has had considerable success. Novelty and repetition are relative terms. Every synthesis of H_2O is an emergent in that we get a new individual thing with new characteristics. But the synthesis can be repeated an indefinite number of times with no apparent difference. It is in the psychological realm, which Schiller stresses, that repetition always means novelty, for the recognition of repetition is itself a novelty. But novelty has meaning only on the background of some repetition; and repetition gets its significance from the new instance in which it is recognized. The important fact which emergence has stressed is that there is real change. Emergence takes time* seriously as part of the very tissue of reality.

But while emergence has done real service in stressing an aspect of nature which philosophers, at any rate, have been prone to overlook, we may still ask what the significance of emergence is for scientific and philosophic theory. Is it a statement of fact? Or is it a principle of explanation? The tendency recently has been to treat emergence as a principle of explanation and to rest satisfied when it has been shown that something emerges. Materialistic emergentists have fancied that they have explained life and mind in the universe by just saying that they are emergents. Now they must explain matter, too, by calling it an emergent. But surely the mere statement of a fact is not an explanation of it. An explanation is not a mere statement of an occurrence, but of the *how* and *why* of the occurrence. We want to know how the electron, the atoms, the molecules, organ-

* I have fought for real time ever since my doctor's thesis, *A Theory of Time*, 1899. See also *Time and Reality*, 1904, *A Realistic Universe*, 1916, 1931, part IV.

isms, mind can occur in our world. This means an enquiry into the structure of a world which makes such things possible. The problem of explanation is the problem of organization. We want to know not merely that novelties occur but how they occur. Emergence calls attention to an important aspect of our world, but does not explain it.

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71. See *Emergent Evolution*, and *Life, Mind and Spirit.*
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80. *Ibid.*, p. 288.
81. *Ibid.*, p. 290.
82. See his brilliant essay, "Creation, Emergence, Novelty," *Arist. Proceed.*, vol. XXXI, pp. 25-36; also "Novelty," *Ibid.*, vol. XXII, pp. 1-22.

Chapter 4

EMERGENCE AND STRUCTURE IN SCIENCE

Emergence in Physics

We have examined emergence historically. We must now try to find what emergence means in the science of to-day. We shall find ample evidence of emergence in the world which science investigates. But we want to see whether it is the emergence of chance or emergence with structure. The language of emergence must of course vary with the progress of science. The ultimate units of matter are now supposed to be electrons; the language of energy has taken the place of inert matter. But the fundamental problems remain in a different dress. We cannot restrict the theory of emergence to the physical concepts of Democritus, even though some of its upholders seem to do so. Is science committed to materialistic emergence? Materialism boasts of being scientific. But it does not follow that science is materialistic. It cannot be denied that the drift of modern science up to the twentieth century favoured materialism, whether individual scientists did so or not. This is not true of recent developments in science. In general, science aims to be descriptive. This does not mean that science denies structure. Scientists have felt—unless sophisticated by philosophic scepticism—that they have been discovering the structure of nature, not reading structure into a formless world. The difficulty has been with the picture-making of science. The mechanical picture with its billiard-ball atoms and their fortuitous external impacts has, until recently, dominated the scientific mind. But the methods and concepts of science are themselves part of evolution and are undergoing radical transformations.

One of these revolutions has come through the theory of relativity. The absolute measures of the Newtonian era have given place to the relative measures of the era of Einstein. In Einstein's special theory of relativity there is no absolute frame of reference. The earth has lost its privileged position and

so has the frame of the fixed stars. All frames of reference are equivalent. It is a matter of choice which one we use. We always regard the frame of reference, which we choose to occupy, as stationary for the purpose of measurements which we make upon it. Thus when the earth is our frame of reference, we can regard our measures upon the earth as constant and absolute, as Newton did. But it is different when we take account of events on other frames of reference in apparent uniform motion with reference to us. Here we find that the units of measurement vary with the space-time perspectives. The lengths and the durations respectively do not appear the same as when we take account of them on our own frame of reference. As a result of motion, the lengths appear shorter and the durations appear longer in the same proportion. There is a different partitioning of space and time. Thus lengths and durations become emergents in the perspectives of nature. By using the velocity of light as an absolute constant, we can transform the units of one frame of reference into those of other frames and thus measure the difference. Since the apparent units of space and time vary in their distribution, the apparent mass and energy must also vary. There is a marked increase of mass when velocities approach the velocity of light. Mass is inertia, and inertia is now regarded as a form of energy.

The occasion for the special theory of relativity was the Michelson experiment, which, though repeated again and again, has apparently shown that it is impossible to ascertain the drift of the ether* with reference to the earth and therefore impossible to establish the absolute velocity of the earth or of anything. But the special theory as it figures in physics at present is quite independent of the Michelson experiment; and, therefore, physicists have been quite indifferent to a possible reversal of the Michelson experiment. The special theory in physics rests on the experimental evidence (of J. J. Thomson and others) that the mass of a body increases with velocity. Such

* It should be added that D. C. Miller, who was associated in a later experiment with Michelson, after long and careful experiments, has announced a positive effect of ether-drag.

increase is negligible at ordinary velocities, but it becomes important in connection with the velocity of electrons which is a considerable fraction of the velocity of light. The velocity of Beta particles, shot out from radium, is ninety-eight per cent of the velocity of light. It is necessary, therefore, to make a correction for mass which is due to velocity. The physicist does not doubt that such phenomena are real under the conditions of the experiment. The fact is that the discovery of the increase of mass with velocity is earlier than the special theory. This merely furnishes a new interpretation. With the relevance of the interpretation, we are not concerned. We must leave that to the physicists. The important fact for us is that the fundamental concepts of science—space, time, mass and energy—have been revolutionized. Their units can no longer be regarded as absolute; and they have been reduced to three—space, time and energy. The dogmatism of nineteenth century science has been broken through in the twentieth century. Truly science is relative.

The special theory of relativity postulates the absolute velocity of light. But the velocity of light also is relative to the frame of reference. For one thing it has been found that light is curved in gravitational fields and so apparently retarded. If the special theory has dethroned the earth from its privileged position in the cosmos, the general theory has dethroned the velocity of light as an absolute standard. The general theory emphasizes that we must understand events in the cosmos as determined by cosmic structure.* Bodies do not pursue their course in space by virtue of some mysterious direct pull which they exercise upon one another—the pull varying with the product of the masses and inversely as the square of the distance. Einstein's theory of gravitation holds that energies, including light, pursue their course in space because of the structure or geometry of the field in which they move. To describe these field relations, Einstein uses a gaussian geometry instead of a

* It should be noted that, in Einstein's general theory of relativity, structure or curvature is local, depending upon matter. We owe to Weyl the conception of "cosmic curvature" of the universe as a whole.

euclidean. The geometry or curvature of the field is conditioned by the dynamic relations of bodies in space. The curvature is very marked in the neighborhood of large masses of matter like the sun and varies with the square of the distance. Thus even the geometrical properties of space become emergents instead of absolute. The orbit of Mercury is determined by the geometry of the field.* This is of course true of the other planets also, though the effect is not observable. Lights rays bend in the neighborhood of the sun, not because of the direct action by the sun upon light—this would account for only half the deviation—but because light follows the curvature of the field, as the split in the wood follows the grain and as the stream follows its bed. Light rays emitted from the atoms of the sun lose in frequency or quanta of energy because of the gravitational field of the sun, and hence the emissions from the elements in the sun are nearer to red in the spectrum than the emissions from the same bodies on the earth, where the gravitational field exercises vastly less influence. All this has now become part of science by the apparent verification of the mathematical predictions of Einstein. What interests us is the new emphasis on cosmic structure. The course of bodies in space is determined —not by the action at a distance of those bodies, but by the structure of the cosmic field. This may be regarded as a permanent contribution, whatever may be the fate of Einstein's theories.

The mathematical form of the general theory of relativity has applicability only to very small distances and is useless for the immense distances with which astronomy is mainly concerned. Mathematical physicists like Weyl, Eddington and Einstein are therefore attempting to find a new type of geometry which will be applicable to great distances. Einstein is experimenting with a geometry which lies midway between the gaussian geometry (of which he made use in the general theory of

* Einstein set three tests: the explanation of the perihelion of Mercury which did not conform to the Newtonian law, the curvature of light in the neighborhood of masses of matter, and the deviation of light, emitted from the atoms of the sun, towards red. Only the first phenomenon was known at the time Einstein projected his general theory.

relativity) and euclidean geometry and which can be applied to large as well as small distances. He hopes further to discover equations of such generality that they may apply to both gravitation and electromagnetism—matter and radiation—two hitherto irreducible aspects of nature. This would be an epoch-making triumph of physical theory, but so far the results have been only approximate. In Einstein's language space would eat up matter. But space in that case would have to assume new properties including direction—a temporal property. The triumph of geometry would be complete. But if the configurations of space are derived in the first instance from the distribution of matter, as in the general theory, the dualism of space and matter would be merely veiled by the equations, not reduced. In Einstein's recent religious utterances it is manifest that this mathematical idealism is capable of giving rise to a high degree of religious emotion. We have the re-occurrence apparently of the mathematical enthusiasm of the renaissance in such thinkers as Descartes and Spinoza. God geometrizes.

A still more radical revolution has taken place in the conception of matter in the twentieth century. The theories of relativity, after all, left intact the fundamental frame-work of the Newtonian era. The new quantum physics has scrapped even the fundamental concepts of space and time and space-time upon which the calculus of science, including relativity, has been founded. There had been little change in the conception of matter from Leucippus in the fifth century B.C. to the end of the nineteenth century A.D. Atoms were conceived as little impenetrable particles of homogeneous substance but differing in shape, size and arrangement. Lucretius, in the first century B.C., suggested that these particles were composed of minima, but that these are inseparable, and therefore the atom remains a solid block. Newton (1704) accepted the suggestion of Lucretius. Lucretius also assumed that the atoms differ in weight. But for Lucretius, as for Democritus, weight is an absolute property of the atom, depending upon the size of the atom, while for Newton weight is relative, depending upon the gravitational context. Weight was destined to play an important part in the

development of chemistry by Dalton (1810) and his successors, in the nineteenth century. Mendeleef's epoch-making discovery of the periodic law of the elements (1870) was based upon the idea that the elements can be arranged in a series on the basis of weight. Lucretius suggested that the kinds of atoms must be finite. Modern chemistry restricts the kinds of atoms to the apparently simple elements, which persist in the various chemical compounds and can be separated and recombined. The constancy of the atoms becomes the constancy of the elements. Some chemists, in the latter part of the nineteenth century, were sceptical about the existence of atoms and regarded them as merely dscriptive indices of quantitative combinations of elements by weight. Ostwald emphasized energy rather than extension. Extension or size had seemed the important aspect of the atom during this period, though Leibniz had departed from the tradition in making energy the fundamental characteristic, and Boscovich had developed an ingenious theory of atoms as systems of mathematical force-points as far back as 1758. This theory, however, had no influence on the development of chemistry; neither did Kelvin's conception of atoms as vortex rings in the ether.

A revolution in the conception of the atom came in the middle of the last decade of the nineteenth century with the discovery, by Becquerel and the Curies, of radioactive elements. It was definitely established that the atoms have individual existence, but that they are composite and liable to disintegration, liberating enormous stores of energy in the process. The conception of atoms as storehouses of energy took the place of mechanical bits of "inert matter." At the end of the nineteenth century, J. J. Thomson discovered the electron and showed that matter is electrical in character. There is no matter except electricity. Rutherford later discovered the proton, the positive nucleus of hydrogen, and suggested the picturesque conception of atoms as planetary systems, consisting of a nucleus of positive electricity (in which the greater part of the mass of the atom is concentrated) and of negative electrons, moving with great speed about the nucleus. The picture appealed to the imagination and

found general favor, though some chemists insisted on a static model. The simplest system is of course the hydrogen atom with a nucleus of positive electricity and a negative satellite electron, revolving around it. With the other elements the relation was found to be less simple, since the nucleus consists of both negative and positive electrons. Thus in helium there are in the nucleus four positive electrons or protons, two of which are neutralized by two negative electrons, bound in the nucleus, while the other two are neutralized by two satellite negative electrons.

If we disregard this internal complexity of the nucleus, and fasten our attention on the protons which have "no lids on" and are neutralized by satellite electrons, we can picture a simple series of elements from hydrogen, with one proton neutralized by one satellite electron, to uranium with ninety-two uncovered protons, neutralized by ninety-two satellites. The progressive series of atomic structures—the natural order, or atomic number, of the atoms—was established by Moseley through his experiments on the spectra of the elements shortly before the world conflict of 1914, in which his life was cut short. Uranium is the heaviest element found in the earth and its atmosphere. But Sir James Jeans suggests that there must exist heavier atoms in the interior of the stars. The lighter atoms would come to the surface, and the earth originated somehow from the surface of the sun. It is impossible, he thinks, to account for the energy of the stars unless we assume the presence, in their interior, of heavier atoms than those we know on earth.

Niels Bohr, while an assistant to Rutherford, made the planetary model more precise by showing that the electrons act in certain energy orbits or levels which are spaced as integral numbers according to a quantum law, established by Planck. The emission of radiation takes place when an electron shifts from an outer level to an inner level, and the absorption of energy takes place when an electron shifts from an inner to an outer level or orbit. The orbits, moreover (as Sommerfeld showed) must be conceived, not merely as circular but also as elliptical. An atom becomes negatively charged when it loses one or more satellite electrons and positively charged when there is an ad-

dition of one or more satellite electrons. Chemical compounds can be accounted for by the sharing of electrons, i.e. one or more electrons form a common bond between atoms, in various arrangements. The Bohr model proved convenient and came into general use. But it had difficulties. The shift from one level to another appeared to be instantaneous, which is impossible to conceive if the electron is a particle and the orbits are spatially separate. Furthermore, according to Bohr, an electron does not produce radiations when it moves in its orbit, but only when it shifts from one orbit to another, which is contrary to classical theory. Bohr did not trouble himself about the anomalies of his model, so long as it was serviceable as an instrument of prediction. And the success at first was astounding. But with more delicate technique in experimentation the theory showed an increasing lack of exactness; and it became evident to physicists, and especially Bohr himself, that a radical change was called for. No one has done more than Bohr to transform the model, as evidence has made it necessary.

A French physicist, Louis de Broglie, turned to the history of the theory of light for a possible way out of the dilemma. The history of the concept of light also started with the conception of particles, though Newton, the inventor of the corpuscular theory, suggested a double concept—corpuscle and wave—for some optical phenomena. The corpuscular theory, however, went on triumphantly for a hundred years before it encountered serious difficulty. With more delicate instruments it was found "that the image of a star in a telescope, when the greatest accuracy is used, is not really a point, but a little diffraction image, consisting of light and dark rings."[1] The corpuscular theory failed to account satisfactorily for the phenomena of interference and diffraction and therefore gave way to the undulatory theory of Young and Fresnel. This theory made use of the conception of field and of electro-magnetic waves—a revolution introduced into physics by Faraday and Maxwell. The wave conception in turn met difficulties when the quantum character of light was discovered by Planck and Einstein at the beginning of the century. Planck found that when

matter was acted on by radiant heat it gave out quanta of energy instead of a continuous stream. Planck at first thought that the pulsations were due to matter and that the radiation was continuous. But this interpretation proved untenable, since the quanta were given out immediately upon the action of radiation, not after an interval which would be required for matter to become charged. It was Einstein who worked out the model of the quantum theory of radiation itself. The quantum theory accounts effectively for the phenomenon of emission and absorption of radiation, but the undulatory theory still remains the most serviceable instrument for accounting for the phenomena of interference and diffraction. Light or radiation has a dual character, as indicated by experimental evidence. Under some experimental conditions it acts as a wave and under other conditions it acts as a particle.

The brilliant inspiration came to de Broglie that matter, as well as light, might have a dual character—a wave character and a particle character. "He therefore boldly conjectured that material particles, such as electrons, must always be accompanied by waves, and that, therefore, both waves and corpuscles must be present at once in matter, just as we already know from the quantum theory to be the case with light."[2] The waves furnish the guidance of the particle. We may be sure that the particle is somewhere in the wave-train, and not outside, though we cannot predict exactly where it is in the wave-train. Since the waves keep trailing off and accordingly lose velocity, the particle varies in velocity with its position in the train. If the packet is short, we stand a better chance of predicting the position of the particle, but in that case the packet spreads so rapidly that the velocity becomes indeterminate, while if the packet is long there is comparatively little spreading, and so we can predict the velocity with some certainty but the position becomes correspondingly indeterminate.[3] We shall return to this dilemma later when we deal with the principle of uncertainty. De Broglie predicted the essential features of electronic waves—calculating their length, vibration number, and velocity. He thus laid the foundation of wave-mechanics.

We have seen that de Broglie frankly accepted the dual aspect of radiation and matter. But such duality is a challenge to science to reduce, if possible, the fundamental assumptions to one. There have been two such attempts: Schrödinger allows physical thingness to waves alone, while Heisenberg allows thingness only to particles. Schrödinger asked why we should postulate the particle at all if the group of waves always keeps pace with the particle. A group of waves can travel as a unit. Schrödinger "imagined that the electron does not exist at all as a granular object, but rather that the electric charge is distributed in the form of an electric field about the atom's nucleus. This electric field is in a state of vibratory motion, which involves both fundamental and higher vibrations at once."[4] He is thus able to account for the quantum numbers of Bohr's model. "The peculiar whole-number character of the states of energy comes out as a result of a mathematical assumption which can be compared with the occurrence of whole numbers in the relation between the fundamental and overtones in vibrating strings."[5] The mathematical relation is more complicated, to be sure, but the general analogy holds. Pythagoras' dream of assimilating physics to music seemed to be realized.

While Schrödinger's electronic wave extends throughout space, the waves cancel out by interference in all but a small region outside the nucleus where there is a mutual re-enforcement of charge density. This region Schrödinger called an energy-packet which corresponds to what had been called an electron. The electron is no longer conceived as a physical entity, but is reduced to wave-mechanics. It is a special case of superposition of waves, when there is interference, and corresponds to beats in sound. When this interference is lacking, "no electron will exist any longer, but the whole neighborhood of the nucleus will be filled with a trembling cloud of negative electricity."[6] Dynamic waves or waves of radiant energy arise in the shifting from one equilibrium to another within the atom. "Bohr's orbital jumps may be interpreted as a resonance phenomenon between the exciting frequency and the natural frequency."[7] A bunch of vibrations will be emitted, perhaps to co-

alesce with another sphere, either adding its energy to existing vibrations or contributing a new frequency. Thus the disembodied electrons effect exchanges of energy. Since the waves can coexist in the same space (like waves of sound), we get rid of the inconceivable instantaneous shift of an entity from orbit to orbit across space. We also get rid of the anomaly of an electron producing no radiations while revolving in its orbit but only in the shifting from one orbit to another. This theory has been able to meet many difficulties of preceding theories, but no doubt it will have difficulties of its own. It seems impossible to account for the persistence of matter if we conceive it simply as waves. After refraction, for example, the waves would be dispersed into space. Waves have a tendency to spread, and it would seem impossible to account for the age of atoms on our earth on the wave theory. There is also the problem of positive and negative electrons. Dirac has suggested a mathematical model which requires only negative electrons. But the duality is generally accepted at present.

The conception of space-time which has played such an important part in the theory of relativity seems to have no applicability in wave mechanics. Schrödinger's wave seems to have an unlimited extension in space and an unlimited duration. Its existence is limited only by external accidents. Since each wave requires the whole of physical space, the relations of waves cannot be expressed in terms of the ordinary three dimensions. Schrödinger, therefore, is obliged to use dimension in two senses. In the case of one wave, dimension means the ordinary co-ordinates. But when dimension is used for the relations of waves to one another it means "degrees of freedom." Thus the relation of two waves must be expressed in terms of six "dimensions". There is, however, nothing to prevent the waves from co-existing in one physical space.

The problem of the continuity or discreteness of the physical substratum of nature seemed in Schrödinger's theory to have been settled in favor of continuity. The electronic wave is continuous though there is variation in intensity. The intensity or "storm area" is in the neighborhood which has been called

the atom and falls off rapidly outside. While the wave seems to be continuous, the relation between phases, and the relation of exchanges of energy which depend upon a conflict or beat of phases, follow a quantum law of whole numbers. But in the further development of physical theory it has not been possible to ignore the corpuscular character of the electron. While Schrödinger developed his system of wave mechanics, another system was developed (indeed had already been suggested) by Heisenberg. The equations of Heisenberg are said to be equivalent to those of Schrödinger, so far as prediction is concerned. But Heisenberg's interpretation is the exact opposite of Schrödinger's. For Heisenberg the particle has thingness, while the wave form becomes a probability curve in the behavior of electrons en masse. The individual electrons are conceived as indeterminate in their action, with a wide range of "choices". The probability of the electron appearing at any phase or level depends upon the intensity which in turn depends upon the number of quanta. The electron is likely to be encountered in an area of high intensity, less likely in an area of lower intensity. At zero intensity the probability of its being encountered is zero. This is the meaning of a wave extending to infinity. In statistical language, we may say that we can predict with comparative certainty where the quantum numbers are large, as in insurance calculations we can predict how many people will die, though we can make no prediction about single individuals.

Heisenberg and his school insist strongly that we must not attempt to use our imagination in physics, by which they mean that we must not attempt to visualize physical entities and their interrelations. We must have no imaginative models such as the original Rutherford-Bohr model. We must have only mathematical equations, and these must merely symbolize observations. But Heisenberg forgets that the concept of particle which he regards as having thingness, is borrowed from our macroscopic experience. It is a survival of classical mechanics. It is a question how far we can use concrete imagination in physics. We cannot, of course, imagine the dimensions of atoms, but imagination is not, therefore, necessarily irrelevant. We are

not limited to visual imagination. We can, like Schrödinger, use auditory and motor imagination for our analogies. We have experience of interpenetration as well as of side-by-sideness. To penetrate to the structure of reality we must indeed use constructions by the reason. This is an insight as old as Plato. Only so can we make our sense experience significant. We must use some sort of models if we are to predict the data of observation, though we must check our models by means of further observation. A mere heaping up of observations will never give us science. A wave of probability is itself an intellectual construction. What does it mean in objective terms? We are told that the wave is not merely in the mathematician's head, that the probability is founded on a property of nature. Does not this mean that there is an objective structure of nature which determines the possibilities of transactions? The individual action may be indeterminate, but the structure which establishes the possibilities of action and the quantum exchanges in the interactions would seem to be determinate. Only in such a case could we say that the probability is a property of nature.

We cannot get along with just the particle concept, for, as Bohr and others have pointed out, we cannot conceive a particle as passing through two holes at once (if we may simplify a crystal grating to two holes). Yet that seems to be what happens in the diffraction of electrons. If we expose a scintillating screen to a stream of electrons, scintillations appear irregularly all over it. But "if we sent out a stream of electrons through two small holes close together and then looked for scintillations, we should find these still appearing as isolated sparks, but the sparks would occur in certain bands, and none at all in between the places where the diffraction theory predicts darkness. But if we afterwards block one of the two holes, we shall destroy the interference and shall get scintillations everywhere",[8] though we cannot predict where the particular scintillations will occur. This picture will serve at any rate to illustrate the experimental results. How does what goes through one hole take account of what happens through the other hole? Such a condition cannot be understood on the particle theory. It re-

quires the concept of waves. Yet if the waves are merely statistical averages of particle action, we have nothing physical except particles. Because Heisenberg visualized electrons as exclusively particles, he was forced into mysticism to account for the behavior of matter. But why are not wave effects as physical as particle effects? The interference bands which result from the diffraction of electrons are certainly physical facts. It is impossible to comprehend how such bands could be produced by statistical waves which exist only in the mathematician's head.

In a crucial experiment by Stern and Gerlach a shower of atoms was passed between the poles of a fixed magnet. According to the particle picture of spinning electrons, "the shower of parallel-moving atoms would be spread out into a broad continuous band. The wave picture, on the other hand, predicts that the shower would be divided into two quite distinct showers, corresponding to the two directions of polarization of the electron waves. The experiments quite definitely confirmed the predictions of the wave theory."[9] It is clear that the particle picture is not adequate to account for all the behavior of matter. If we recognize, as Heisenberg does, that physical entities, such as electrons and atoms, are inferences from the observed transactions in nature, then we are as justified in interpreting matter as having the wave character under the conditions when it acts as waves, as we are justified in ascribing to it a particle character when it acts as particles. One character is as physical as the other; and, as Heisenberg has pointed out, the two characters are not contradictory but complementary. Heisenberg's statistical waves confuse a method of knowing *(causa cognoscendi)* with a principle of action *(causa fiendi)*—epistemology with physics or metaphysics. The equations of Schrödinger and Heisenberg apparently work, but their interpretations of their equations will not work.

We may say that recent experimental evidence indicates that matter has the same dual character as light. Phenomena of interference and diffraction have proved that light consists of waves. Again, the phenomena of emission of light and the bombarding of electrons and atoms by means of light show that light must

be corpuscular. The energy of light depends upon the frequency solely. It has nothing to do with the distance from the source. If light and other radiant energies such as heat rays, X-rays, gamma rays, were undulations in a material ether, their energy should decrease with the square of the distance. But the evidence shows that this is not true. What decreases with the distance is the intensity of light or the number of quanta. The individual wave delivers its energy intact. Recent experiments (by Davisson and Gormer in America, who were the first to test the wave theory of electrons, and G. P. Thomson and others in Europe) on the interference and diffraction of electrons leave no doubt that electrons also have a wave character. This has also been demonstrated for atoms. The results are similar to those of the interference and diffraction of light. On the other hand, bombardment of electrons by light and by other electrons shows that electrons act as corpuscles. The corpuscle of light is called a photon and the corpuscle of matter an electron. The wave of light is called an electromagnetic wave, but the wave of material energy has no name. A. H. Compton calls it a de Broglie wave, from the scientist who first associated waves with the electron. Can the dualism indicated by experimental evidence be bridged by theory? The ingenious theories of Heisenberg and Schrödinger do not seem to bring us nearer to a metaphysical solution, though their equations work. It must be that the equations veil the dualism which the theories deny. Perhaps the difficulty is with our preconceptions. We borrow the concepts of waves and of pellets from our macroscopic sense experience. When we deal with the elementary stratum of our world, both of these concepts, borrowed from the macroscopic level, are too definite and precise. The elementary energies of nature may be neither waves nor pellets, but by using both concepts we seem to be able to deal with them.

There have been various attempts to soften the dualism of waves and particles. It has been suggested that we should combine them and call the hybrid a "wavicle". But this merely indicates that we find both our macroscopic concepts useful for different purposes. We know of no entity which is both wave

and particle in the same relations. We do not solve the problem "by grasping both horns of the dilemma", so long as *we* carry the horns. And if the mathematician's solution means merely new symbols for our macroscopic horns, we are no nearer to an understanding of the primary level of nature, though our equations seem to work. Compton suggests that, "instead of the electron or photon being assumed to persist between the occasions when we observe it in transactions, it would be equally permissible to suppose that light or cathode rays (electrons) alternate in form between particles and waves. While moving from one place to another they would spread out as waves, but when producing any physical effect they would materialize into discrete particles."[10] But what meaning can wave have except as a mode of reaction under certain conditions? Darwin expresses the "hope that the theory will ultimately take some such form as the following. As far as concerns the wave-aspect there will cease to be electrons at all, but only a sort of electrical juice. It will be the step from wave to particle which automatically cuts the juice into units, and thus it will be the observation that creates the electron. In some such way as this the electrons would have no individuality at all from the very start, which is what we would like."[11] But Darwin forgets that it is also the conditions of observation which make the electron behave as a wave. What it might be without the conditions of observation is useless speculation. We cannot say with Compton and Darwin that when photons or electrons do anything they act as particles, for they certainly act as waves in interference and diffraction. Why should we limit the concept of action to bombardment? This seems to be a prejudice carried over from the mechanistic theory. It is difficult to change our mental habits over-night.

One way of getting around the duality of wave and particle is to assign them to different levels of reality. C. G. Darwin compares the two half-worlds and their interdependence to the duality of things as objective and things as perceived. "There is a close interdependence between the objective thing that we see or hear and our subjective sensation of sight or hearing and

yet the two use wholly different languages. When a string on the piano vibrates 256 times a second, we hear 'middle C' without any conception that there is anything happening 256 times; and when an aether vibration with twenty thousand waves in each centimeter strikes our eye, we see yellow, an ultimate sensation giving no hint of a wave-motion.''[12] But Darwin here is assuming dogmatically the old metaphysical dualism of common sense, viz. that there is an independent world of objective things which we can contrast with the world as perceived. No doubt the world as perceived has emergent qualities which vary with the conditions of perception—vary with the stimulus and vary with the organization of the organism stimulated. It is the whole-situation—including the external as well as the organic condition—which has the character of a certain tone or a certain colour, just as it has a certain size or motion. The perception of tone or colour is no more subjective than the perception of size or motion which also includes the organic factor as well as the external factor. How do we know that ''the objective thing'' has so many vibrations per second except by experiment and observation? If being perceived makes a character subjective then the vibration character is as subjective as the tone or colour character. The correlation between them must also be a fact which can be perceived. If there is a correspondence between the wave-aspects and the particle-aspects—between wave-length and momentum, between frequency and energy, between number of nodes and angular momentum—such correspondence must be capable of observation under the conditions of the experiment, and therefore it is surely gratuitous to suppose that the wave-characters are independent of observation while the particle-characters are dependent. It is certainly naïve to say, as Darwin does, that we have direct experience of a bullet but not of a wave. Macroscopically we have direct experience of both. Microscopically we have direct experience of neither. Both are inferences from the experiments. The action of electrons and radiations on a scintillating screen is like that of bullets. The action through a finely grained crystal is like that of waves, with alternate light and dark bands. The action

in one case is surely as objective for observation as it is in the other.

Darwin tells us that "the new physical theory differs from the old in that observation plays an active part in it instead of merely being taken for granted."[13] We are accustomed to think that the observation makes no difference. But it is through *the conditions of observation* that we get our evidence. Even if we do not observe the direct effects, there must be associated effects, which can be observed. So we can judge of the changes in the earth's crust, which have taken place in a long history, as a result of the action of radiation or mechanical and chemical changes. "It is meaningless to ask what has happened, unless there is either a direct or an indirect observation to tell one."[14] We can have no knowledge except by observation; but to say that no changes could have taken place in the earth's crust unless they were observed at the time is to confuse the conditions of knowing, the *causa cogniscendi,* with the conditions of becoming, the *causa fiendi,* as Schopenhauer pointed out. We must recognize, however, that the latter are for us a matter of inference.

It seems clear from the evidence that we are obliged to recognize the particle aspect and the wave aspect, whether of matter or of radiation, as equally objective and fundamental. They are complementary aspects of nature under different experimental conditions. The attempt to state physical theory in terms of either to the neglect of the other runs amuck on the evidence. If we attempt to use the particle aspect exclusively we cannot explain the diffraction results. If again we centre on the wave aspect we cannot explain why photons and electrons should hit like bullets all over a scintillating screen. It is true that under certain experimental conditions an electron acts as a wave of very short wave length. But a packet of waves, even though it travels as an individual, spreads round the edges and must ultimately spread all over space. The existence of fossils with their form unchanged after hundreds of millions of years shows that matter cannot be adequately accounted for on the wave theory. Even radium lasts for over a thousand years though

it is all the time sending out a spherical wave in all directions. Matter has too great permanency to be accounted for solely on the wave theory.

Mathematical physicists have enjoyed the atmosphere of mystification which their complicated formulae have made possible. They have informed us that we must not try to make any sensible models of the primary level of nature. We must think of it merely as mathematical waves or curves of probability. We must not ask what the waves are waves of. They are just waves in the equations. Recently there has been a reaction from this mystification. Physicists are beginning to recognize that we have no other evidence than sense experience and that our mathematical models, however complicated, are merely symbolic statements of the data we derive from sense experience. It is from these humble data after all that we must derive the categories of the structure of nature—the building materials (matter), the building site (space and time), and the principles of the architecture.* The chemists have held aloof from the mathematical orgy and have tried to make workable the more imaginative models of Rutherford and Bohr by proceeding from the direct evidence of the structure of matter in the X-ray spectography of crystals. A recent experiment by Jesse W. M. Dumond at the California Institute of Technology shows that the earlier imaginative model of the atom by Rutherford and Bohr contains important truth. Whatever the electrons may be between encounters, they exhibit motion and individuality in the encounters. The multi-crystal X-ray spectograph, with fifty crystals suitably arranged, shows that the electrons are not static but constantly in motion around a nucleus.

In shooting X-rays into matter, we may picture three states of electrons—first, those that are bound in the nucleus which are not free to move and which leave the incident wave-length unchanged, secondly those that are relatively free to move but have practically no initial momentum, and thirdly those that

* This tendency is shown in the book by C. G. Darwin already cited and also in the sane work, *The Nature of Physical Theory*, Victor F. Lenzen, John Wiley & Sons, 1931.

are in constant motion or have considerable initial velocities of their own. "If we should therefore scatter the X-rays coming from a certain tube—let us say one with a target of molybdenum—and should pass the reflected, or scattered, rays through an X-ray spectograph upon a photographic film, we should expect to find in the resulting spectogram not only the clearly defined lines of the characteristic spectrum of molybdenum (due to the tightly bound electrons which cannot recoil), but, *in addition,* certain shifted and broadened bands, which are caused by the alteration of the wave lengths of all the spectral lines of molybdenum through the action of both the second and third kinds of electrons which we described a moment ago. A small number of the free electrons have nearly zero velocity and produce through their constant recoil a constant deflection of the original lines. But this is covered up and masked by the broad band of wave lengths caused by the randomly directed momenta of the electrons having initial velocity of their own. It is the presence of these *both broadened and shifted* lines in the spectograms taken with the multi-crystal spectograph which proves that electrons are not static, as was once believed, but are constantly in dynamic motion within matter. This proof is especially convincing because the amount of broadening obeys laws in accord with the 'Doppler' explanation of the moving mirror's effect upon light."*

I am giving this account of an important experiment, because it shows that it is not illegitimate to use our imagination in physics but, on the contrary, an imaginative model makes possible relevant anticipations of nature. Such experiments prove the reality of the particle aspect of the electron. They do not disprove the wave aspect, established by other experiments. The two are not contradictory but complementary. It is the wave aspect which shows how an electron may be immanent at two energy levels at once and how two electrons may occupy the same space (though not in the same function) in certain experimental reactions. This the particle aspect could not explain.

* "The New X-ray 'Microscope'," Gaylord Johnson, *Scientific American,* May, 1932, pp. 280, 281. The article gives a complete picture of the apparatus and the process.

For both aspects of nature—the wave aspect and the particle aspect—we have the analogies of sense experience. The combination of them as complementary is the great novelty, but this too is based upon the evidence of sense experience. New discoveries will throw further light upon the problems of light and matter but they must start from the same homely basis. The recent discovery of the neutron—a state of matter in which the proton and electron are so close together that they completely neutralize electric properties—is a further evidence of the value of the visual model of the atom and seems likely to solve many problems of "radiation" and give us a new clue to the density of white dwarfs. Heisenberg has announced a new model of atom building from neutrons and protons. And now comes the news[15] of the discovery of the positron, the positive electron, which has the mass of the previously discovered negative electron. This discovery must have a profound effect upon our conception of matter. The discoverer of the positron, Carl D. Anderson, of the California Institute of Technology, urges search for the negative proton which would bear a relation to the positive proton corresponding to the relation of the positron or positive electron to the negative electron. The success recently in synthesizing heavier elements from lighter ones, with corresponding liberation of energy, marks a new chapter in science which heretofore had only succeeded in breaking down heavier elements. Thus science is in perpetual flux because it is alive and grows. I do not, however, want to give the impression that metaphysics is journalistic in the sense that it must vary with the news of science, though the news may affect metaphysics. Metaphysics is concerned with the trend of science more than its news. As the intuitions of the great Greek pioneers, in whose footsteps I have trod, have relevance today, as I have tried to show, so I may hope that my metaphysical interpretation may have relevance two thousand years from now!

The Principle of Indeterminacy

One of the most interesting recent developments in physics is the apparent discovery of indeterminacy on the primary level

of nature. It should be noted that the recognition of indeterminacy in the new physics antedates Heisenberg's principle of uncertainty. The phenomena of absorption and radiation in atomic matter indicated to Bohr that it is not possible to predict the precise shift of an electron within the levels of the atom. The shift of the electron must occur according to quantum numbers, but it cannot be predicted, if you take a single electron, to what level it may shift, if at all. Bohr visualized the levels as planetary orbits. The visual model has difficulties, but the levels at any rate remain. Dirac has formulated a general principle of indeterminacy in nature: "When an observation is made on any atomic system . . . in a given state, the result in general will not be determinate, i.e. if the experiment is repeated several times under identical conditions, several different results will be obtained. If the experiment is repeated a large number of times, it will be found that each particular result will be obtained a definite fraction of the total number of times, so that one can say that there is a definite probability of its being obtained any time the experiment is performed. This probability the theory enables one to calculate. In special cases, the probability may be unity, and the result of the experiment is then quite determinate." But can we be sure that the conditions are identical? Planck and Einstein still believe that further experimentation may show that the result is determinate. Planck goes so far as to say that determinism is a necessary postulate for physics. As evidence of spontaneous indeterminism in nature, it has been pointed out that it is impossible to predict which of the billions of radioactive atoms shall explode at a given time. Here certainly our knowledge at present is indeterminate. The great majority of physicists, at any rate, believe that indeterminacy has been established as an experimental fact. It is certain at any rate that the dogma of determinism has been exploded. Determinism and indeterminism are methodological postulates; and the weight of the evidence admittedly at present favors indeterminism.

Heisenberg's principle of uncertainty points to a fundamental dilemma involved in the conditions of nature as we observe it.

In its simplest form "it states that we cannot know absolutely both the position and velocity at the same time."[16] To track any entity in space and time we must be able to make a definite statement about its position and its velocity. If we fail to do this, we cannot have prediction. The old physics postulated permanent properties in nature and absolute units of space and time. It assumed that the course of nature is independent of the transactions by which we observe nature. If we knew the position and velocity of a particle at any instant, we could read off the past and future of nature to infinity. But now it turns out that we cannot know the position and velocity of anything except in transactions. Nature is dynamic, and the transactions by means of which we try to observe nature enter into the character of nature. The characteristics of nature are no longer conceived as persistent but as emergent.

The most remarkable thing about the principle of uncertainty is that physics seems to have discovered real time. Heretofore it has done its business with a spatialized substitute of quantitative instants, which are a convention for measuring the passing of time when everything has been abstracted from change except the mere quantitative passing. Real time, however, is bound up with emergence and the particular emergent cannot be predicted. It can be described, including giving it position or momentum, only *a posteriori,* i.e. we can only predict the past, not the future, which is of course, a paradox. Zeno of Elea showed that there can be no motion in a space and time made up of points or positions. The arrow sticks in the point, i.e. is stationary at an instant. I have been concerned with the problem of time in metaphysics for the last thirty years.[17] It is interesting to see the problem bob up on the primary level of electrons and photons. My problem concerned judgments on the human plane. We cannot define temporal process at an instant without stopping the process and then it is past. The temporal process itself always belies any instant we assign to it. Hence it calls for new judgments. We cannot say what the meaning and value of anything is except in retrospect. We may imagine what a future meaning or value will be, but the possession of it involves fur-

ther activity which alters the valuer and the value. The future brings its own emergent perspective. "We act forwards but we know backwards", said Kirkegaard, the Danish poet. Now the physicist agrees with him. We must not forget, however, that our action directs our knowledge forward. Else our knowledge would be useless.

Heisenberg is not concerned with human judgments on the psychological level, but with human judgments of the velocity and position of electrons and photons. According to Heisenberg, experiment can indicate the position of an electron or it can indicate its velocity with a fair degree of definiteness, but the same experiment cannot indicate both its position and its velocity at the same instant. The experiment, which is designed to indicate position, leaves the velocity uncertain; and, vice versa, the experiment which indicates the velocity leaves the position uncertain. As you succeed in determining one of these aspects the other grows indeterminate, though the description may be sufficient for rough purposes. The root of the difficulty lies in the fact that there is no way of taking account of the position or velocity of an electron without changing it. To observe it you must use light, or some form of radiation. Ordinary light is too coarse-grained for dealing with electrons, so we must use X-rays. But radiation is energy and acts upon the electron, thus changing its momentum. The photon of radiation is similarly altered in the transaction; and since you cannot observe either the electron or the photon except in transactions, you cannot know the position or velocity of either apart from the transaction. "In any such interaction a complete quantum is involved; and the passage of this quantum, altering to an important extent the conditions at the moment of our observation, makes the information out of date even as we obtain it."[18] If we use soft X-rays, i.e. X-rays with a relatively long wave length, the momentum of the electron is not seriously affected, and so we get a fairly precise measure of velocity, but the position is blurred. If, on the other hand, we use hard X-rays, i.e. X-rays with short wave length, we get a sharp picture of position, but the velocity has been radically altered, because of the

great energy of the X-rays. If we should attempt to ascertain the energy, contributed by X-rays, we must have them act on something; and so new problems arise. It is obvious that we can get no information from nature except through transactions. We observe events, but events are junctures of energy streams in nature. We cannot know the properties of anything except in interactions. On the billiard ball theory the problem was simple, because we assumed permanent properties on the part of the entities; and though we could get no information except by interactions, we could easily partition the contribution of the factors in the event. But now we recognize that the factors themselves are altered in contributing to the event, i.e. we have to do with a fact of emergence, instead of mere mechanical distribution.

The problem is fundamentally the same on the macroscopic plane except that there we deal with large quantum numbers and so observe the results en masse instead of trying to track individual electrons or photons. To observe the moon there must be light playing on the moon, beside the transaction of light-on-the-moon playing on our organism. What is the moon-in-itself? We can get no answer to that question because it is nonsense. What if we do assign or imagine a relay of "watchers", as Eddington proposes? The watchers cannot observe anything but transactions in which they themselves are involved. What existence does the moon have when it does not interact with an observer? We can know such existence only indirectly, i.e. by inference from the effects of tides and other effects upon our environment.

Berkeley said that the perceptions of the moon (including the sun-shining-on-it) are created in us by God on the occasion of the observation. The mathematical form is of course also furnished by God. Hence we have the regularity of nature. The moon for Berkeley has no existence except when there are "watchers". It is certain that a different moon emerges when there are "watchers". The character of the moon varies with interaction. The results of science are as valid and valuable on Berkeley's theory as on any other theory. "It is only to satisfy

our sense of continuity", says Compton, "that we assume that an electron or a photon has a real existence between the occasions at which it acts on other particles." Perhaps it does not. Perhaps electrons and photons are themselves temporary emergents in the interaction. For Berkeley God furnished the continuity. We find it easier to conceive the continuity *in* nature. We are no longer troubled by an inert matter, for matter is energy. But we know energy only by what it does in the transactions of nature. I do not see why a physicist, who takes entropy as absolute, should object to Berkeley's solution, for such a physicist requires a supernatural magician to call the universe into being, and it is certainly as conceivable that nature is a perpetual transaction with Berkeley's God.

It seems that the difficulty in establishing either velocity or position occurs when we try to ascertain it at some future instant. Otherwise it is supposed that we can simply assume that it goes on from some point in the past with a definite velocity, i.e. the difficulty presumably is not with the terminus *a quo* but with the terminus *ad quem*. Who is not familiar with Newton's law of inertia, i.e. that motion persists, unaltered, unless there are encounters? But that is an *a priori* law, suggested by macroscopic experience. I do not see that it helps us to put the instant in the past, rather than to put it in the future, since we cannot know the velocity at any instant, without complicating it as already indicated. How can we know the velocity of an electron without an encounter in the past? We can know the velocity after any encounter only by means of another encounter. It must be a hypothetical velocity, then, that the mathematician is talking about. After an encounter, the photographic plate will of course show that there has been an encounter and we can estimate the momentum. But what about its velocity before the encounter?

In practice, the problems of ascertaining position and of ascertaining velocity are bound up together. The uncertainty in either case inheres in the conditions of observation. When these conditions are so arranged as to be favorable for observing position, they are necessarily unfavorable for ascertaining velocity

and vice versa. There seems to be no way around this dilemma. The old physics ignored the conditions of observation and therefore could speak of absolute position and absolute velocity. But now we know that velocity and position have meaning only with reference to interaction. "Wave-mechanics theory does not enable us to locate a photon or an electron definitely except at the instant at which it does something. When it activates a grain or a photographic plate or ionizes an atom which may be observed in a cloud expansion chamber, we can say that the particle was at that point at the instant of the event. But in between such events the particle cannot be definitely located. Some positions are more probable than others, in proportion as the corresponding wave is more intense in these positions. But there is no definite position that can be assigned to the particle in between its actions on other particles. Thus it becomes meaningless to attempt to assign any definite path to a particle. It is like assigning a definite path to a ray of light: the more sharply we try to define it by narrow slits, the more widely the ray is spread by diffraction."[19]

Position in the abstract is easily defined, but position in the concrete is an emergent fact, involving interaction. The precision of the position lies, in other words, in the scheme we submit to nature—our mathematical points and lines. It seems evident that the concepts we have borrowed from the macroscopic plane of experience cannot be carried over to characterize the situation on the primary level of nature. Particles and waves and the position and direction of motion of particles and waves are familiar concepts on the macroscopic plane, but when we carry these concepts to the microscopic plane unforeseen difficulties develop. Particles and waves, position and velocity, are here seen to be relative facts. They are not absolute facts as our common sense supposes. The limitations are betrayed in the principle of indeterminacy. We get on with these concepts on the macroscopic plane because we deal with large quantum numbers. That is the reason we have no difficulty in encountering the moon, i.e. assigning it a position in space, while there is uncertainty in encountering an individual electron.

To state the uncertainty of encountering an electron with decreasing intensity, i.e. as the electrons become fewer, as a "choice" on the part of electrons to appear at one level rather than another is again an evidence of the tendency to describe behavior on the primary level of nature in terms of concepts derived from the macroscopic—in this case the highest macroscopic, viz. human volitions. All that the evidence shows is that the postulate of determinism, which the mechanistic theory similarly borrowed from the macroscopic level, is not applicable to the primary level of nature. But the physicist's intimacy with the primary agents of nature makes them seem alive and conscious, which in a sense they are, even though not in the sense of higher levels. They show "traces", intimations, of what we find on more complex levels. How different this attitude of the new physics from that of the old physics with its inert matter, which reflected so well the deadness of the old naturalism! The new physics is more akin to Plato's intuition, that as we strip reality of its layers of concrete organization we arrive at last at the contingent or indeterminate. But this is a limit of thought, which strips the contingent of structure. The physicist's primary level seems to have structure, though not the structure of the macroscopic level. The permissible levels are determinate in nature and give us our quantum numbers, though the appearance of the electron or photon at any one of these levels is contingent. It is interesting that Plato also used psychological language in speaking of his lowest level. The Demiurge persuades the indeterminate and contingent to fall into patterns, and is successful "for the most part." It is a long way, however, from "choice" on the primary level to the organized choice on the human plane.

It is plain that the physicist is becoming deeply involved in metaphysics. Perhaps because of his inexperience he is asking questions to which in the nature of things there can be no answer. Such questions may be: What are things, when they do not act? Where are they, when they do not act? How fast do they move when they do not encounter anything? The physicist might have gone for advice to the philosophers, but in that case

he should have become more confused than ever, since philosophy has followed no definite method and is for the most part in the grip of the old physics which has now broken down. We may hope that out of the new physics may evolve a more intelligent metaphysics.

The demand for continuity in nature is a deep-seated one. Our macroscopic habits are strong and not easily broken through. The old physics had assumed that things in their potential state, i.e. between encounters, are precisely what we find them in encounters. The pellets which it assumed as the units of nature were not affected intrinsically by encounters. An encounter was a merely external relation. The conception of the continuity of nature was simple on this theory. But now we are facing the question whether the characteristics of electrons or photons may not be due to the conditions of the encounter. Whether they appear to have the characteristics of particles or waves may be due to the conditions of the experiment. They may be neither particles nor waves in themselves, i.e. between encounters. The characteristics of particles or waves may be emergent characteristics. It is the state of energy between encounters—the potential state—which furnishes the problem of uncertainty, and which makes prediction uncertain. Electrons and photons cannot be tracked individually between encounters, for the simple reason that we can observe them only in encounters. It is reasonable to suppose that they owe their individuality to the conditions of encounter. Individuality is an emergent quality—familiar in molar motions.

The physicist has come up against the problem of emergence where it was least expected, namely on the primary level of nature which has been heretofore conceived mechanistically. Still in bondage to an old tradition, the physicist continues to talk of particles and recoil, as though he were dealing with billiard balls. But the evidence indicates that particles, velocity and direction of motion, as we observe them, are emergents, depending upon the conditions of observation. Evidently the motion of an electron cannot mean molar motion if it is instantaneous. And the motion of light cannot mean molar motion, if it makes no dif-

ference to the relative velocity of light whether we move in the same direction or in the direction opposite from the supposed motion of light. We may well question, with G. N. Lewis, whether the macroscopic conception of motion-of-light has any relevance to nature. Perhaps what the Michelson experiment really proves is that we cannot ascribe our macroscopic concept of motion to light. In that case the special theory of relativity, which is based upon the motion of light, becomes a pragmatic device which helps us to get results but covers up the real problem. The Doppler effect, which is based on the motion of the frame of reference with reference to light, would have to find a new explanation, if light does not travel. What does it mean to say that light travels 186,000 miles a second? We must wait and see.*

The fact of emergence is given a universal expression in Dirac's "mystic formula", $qp—pq = ih/2\pi$. As Eddington says: "Obviously q and p cannot represent simple numerical measures, for then qp—pq would be zero."[20] Eddington suggests that "in digging deeper and deeper into that which lies at the base of physical phenomena we must be prepared to come to entities which, like many things in our conscious experience, are not measurable by numbers in any way; and further it suggests how exact science, that is to say the science of phenomena correlated to measure-numbers, can be founded on such a basis."[21] It would appear at any rate that the entities with which the physicist deals in his attempt to come into intimate relations with nature are not the hard and fast kind which the billiard ball conception of atoms indicated. We are dealing with more fluent entities in the transactions of which emergent characters cannot be ignored. New laws of addition and subtraction must be invented, as Heisenberg has shown. The resultant may be greater than the sum of the parts. It may be a different type of entity. The physicist still seeks for order or structure in these emergent situations in nature and is having considerable success. But his attitude to the significance of this structure has greatly changed.

* For a discussion of the velocity of light see *The Logic of Modern Physics*, P. W. Bridgman, 1927, p. 100 f.

Some physicists are looking to psychology for the analogue to their material. Eddington feels more at home with his material when he thinks of it as mind-stuff. We can see the significance of Dirac's q's and p's if they stand for operations on the psychological plane. Let p indicate the operation of eating dinner and q stand for a full stomach. It makes a great deal of difference whether the operation of eating dinner precedes the condition of full stomach or comes after. It makes a difference whether funeral flowers precede the death of the individual or come after (when he can endure them). Eddington realizes that we must simplify the conception of mind-stuff, if we apply it to the simplest level of nature. "The mind-stuff of the world is, of course, more general than our individual conscious mind; but we may think of its nature as not altogether foreign to the feelings of our consciousness."[22] Such a conception is at any rate a corrective for the deadness with which custom has invested inorganic nature. To the physicists dealing directly with individuals instead of the mass aspects that our senses give us, nature becomes sensitive, elusive, even mystical.

W. K. Clifford, a brilliant physicist of the nineteenth century, sought similarly to establish a principle of continuity between the physicist's mind which does the investigating and the physical material which he investigates, and thought that feelings, mind-stuff, must be the ultimate basis of reality. It is true that the symbolic descriptions of the scientist do not reveal the qualitative nature of the material with which he deals whether in psychology or physics. But we must not overlook the emergent characters at various levels in the creative synthesis of nature. Psychical characteristics seem to be such emergent characters. And it is a question whether such characters, borrowed from the human plane, have any relevance when applied to nature at its simplest level. This difficulty did not appear to Clifford because he supposed that there are certain constant units out of which nature is compounded, and they might be called either atoms or feelings. It is interesting that the physicist's feeling for the continuity of nature may lead him to read nature from the higher to the lower, instead of from the lower to the higher, as the ma-

terialists have done. If there is to be reduction it seems more plausible to reduce matter to mind, with which we have first-hand acquaintance, than to reduce mind to matter with which we can have no first-hand acquaintance. But we should not overlook the emergent aspects. It is refreshing to have the physicist recognize the reality of the level of psychology. After all, it is there that the physicist lives and it seems gratuitous to ignore it, if not to disown it as irrelevant, as the physicists were at one time inclined to do.

A biochemist, A. P. Mathews,[28] postulates a psychic element in addition to the material elements. He thinks this psychic element is the most characteristic, one might say the characteristic thing, in living organisms. While we have not recognized it anywhere else than in living things, Mathews thinks the psychologist of the future will have to discuss the psychology of hydrogen and oxygen, yes even of electrons. He quotes the saying of Du Bois Reymond: "The atoms of iron in the great driving wheel of the locomotive and in the brains of the poet are the same." But can we say that they are the same? Or do certain characters emerge in the conditions in each case? Mathews suggests that we should find out more exactly the relation between the psychic and the material. Can the increase in psychic potential bring about a change in the rate of oxidation? The biologist must try to invent an art for measuring the amount of life—perhaps indirectly by measuring respiration (Tashiro) or electrically by the current of action. As yet, he thinks, we are ignorant of the dimensions of psychism. We have been concerned merely with the dimensions of material energy. But in omitting to take account of psychism in chemical actions we have failed to give more than half a description. In accounting for water we should state not merely the conventional H_2O but we should add P for psychon with the appropriate index.

Mathews, like Eddington, makes a laudable attempt to get away from the old artificiality and deadness. I agree that really to account for such a synthesis as water, we need more than the conventional symbols. But adding a psychon seems too artificial and neglects the fact of emergence. No doubt Mathews would

reply that emergence is merely a name for the unique result and does not explain it. In that I should agree with him. But if we use psychological language on the level of chemistry, we must take care to leave behind us the associations from the human level. Again, as in Eddington's case, the attempt is hopeful, and shows a laudable dissatisfaction with the old mechanical conception of things. To speak of the unique organization of water as the soul of water is to recognize that form is the spiritual aspect of water. Nature is not the lifeless shuffling of lifeless blocks.

The concepts of physics are in a process of rapid evolution and it is impossible to predict the future. One problem, according to Einstein, is how to reconcile the theory of relativity with the quantum theory. At present they seem irreconcilable. There are indications, however, that the two great tendencies in present thought may supplement each other. "The new quantum mechanics, when applied to the problem of the structure of the atom with point-charge electrons, does not give results in agreement with experiment. The discrepancies consist of 'duplexity' phenomena, the observed number of stationary states for an electron in an atom being twice the number given by the theory."[24] This difficulty in stating the phenomena of emission of radiation, Dirac shows, is "due to the incompleteness of previous theories, lying in their disagreement with relativity, or, alternately, with the general transformation theory of quantum numbers." In this case relativity theory comes to the rescue of the quantum theory. By introducing a correction for relativity, Dirac was able to square theory with the evidence. We may conceive three types of fields with their geometry—Euclidean space which is space in the absence of masses of matter, the gravitational field, which is space determined by masses of matter, and the electromagnetic field. Each type of space or field involves certain determinations of its own. The electromagnetic field according to Einstein is independent of the gravitational field. But it seems as though the gravitational field must in the last analysis depend upon the electromagnetic field, since bodies are concentrations within the electromagnetic field and gravitation depends at any rate indirectly on bodies.

It must be evident that the new discoveries in science have radically altered the whole framework of principles upon which modern science was founded. What becomes of the principle of identity upon which Emile Meyerson thinks that science is founded? It seems to have no meaning any longer. Take Newton's first law of motion—the law of inertia or persistence. We can no longer say that a particle persists in its motion unaltered between encounters. The law was founded upon macroscopic entities and macroscopic motion, where we ignore the conditions of observation. But the conditions of observation are a factor here as well as on the microscopic plane, though the vast number of entities produce a statistical average which gives the illusion of identity. On the microscopic plane where we deal with an individual entity or at any rate with few entities, the principle of uncertainty points out that the conditions of observation enter as part of the situation and that we cannot ascertain both the position and velocity of an electron or photon at the same time, i.e. by the same experiment. We know position or velocity only by means of observed encounters, and the encounters must be different for the ascertaining of each. We can say nothing definite about position or velocity between encounters. There is no way of tracking an entity, whether electron or photon except by a medium which makes it visible, like X-rays, and this means an encounter which changes the conditions. If we could only see without light, we could follow the entities in their course! But that is absurd. Emergence takes the place of identity as a fundamental principle. Even the particle-character and the wave-character themselves are emergents. We cannot predicate a particle previous to the encounter. We cannot follow its track in space and time between encounters. We have only statistical probability of its emergence, and this probability becomes high in proportion to the intensity, i.e. the numbers involved.

The old conception of causality, which was based upon the apparent macroscopic possibility of tracking entities in space and time and predicting definitely their conjunctures, must go. Even on the macroscopic plane the certainty is merely statistical. This does not mean that there is no real causation—nothing but

invariable antecedence and consequence. The latter conception is useless since we cannot observe antecedance and consequence. We know for certain only consequence—the juncture of energies. The antecedent state of the entities is a matter of uncertainty. But we can be sure that there are real transactions in nature. When an X-ray photon collides with a free electron, something happens. The X-ray photon loses in wave length as the electron gains in momentum. To this extent the general postulates of conservation of energy and of entropy still hold. This, however, is a very simple instance. When the conditions are more complicated, we cannot say that there must be a definite partitioning of energy. If the electron is bound in the nucleus, the reflection of the photon takes place as though nothing had happened. The photon remains intact. There is no subtraction. We have an analogous situation on the complex neural level. If two reflexes strive for dominance, the dominant reflex is executed as if the other did not exist. In neither case do we see a vector resultant.

The operations of addition and subtraction become experimental, instead of *a priori* as in the old science. Only experiment can show whether the result of addition of 1 ± 1 is one (as above) or is zero (as in adding a positive and negative charge of electricity) or two or more than two. In the case of electron-magnets Heisenberg showed, by using the empirically derived Exclusion Principle and antisymmetric waves, "that in fact the force acting on each of the electron-magnets was not simply the sum of the forces from all the rest, and that under certain conditions it could be enormously greater."[25] In this way Heisenberg was able to explain the enormous concentration of magnetism in iron. "In a general way Heisenberg's work draws attention to the enormously important fact that the joint influences between a number of bodies cannot be estimated by simply taking them together in pairs."[26] We need not call attention again to the fact that the resultant may emerge as a new entity with new properties. The net result is that measurement and congruence become experimental facts, having no meaning aside from the conditions governing the operation. They

can no longer, as in the old science, be based upon *a priori* principles.

The *a priori* conception of the impenetrability of matter, which dominated science for so long, becomes a fiction. Electrons can overlie one another—occupy one another's space because in one aspect they are waves or vibrations. We have to revise our idea that two bodies cannot simultaneously occupy the same space. They may be immanent in one another. "We have seen that the waves of two electrons can certainly overlie one another in the same part of space, and so we must find a new principle to replace the idea of impenetrability. We express it by saying that two electrons may be in the same place, but that they must not be doing the same thing. . . . Roughly speaking . . . if an electron is behaving as a wave of some particular kind, then no other electron (in the same space) can be that same kind of wave."[27] Not only do we have to alter our conception of relations in space and transformations in space, but we have to alter our conception of space itself. It is no longer the *a priori* neutral entity it was in the old physics but has empirical and emergent properties. According to Einstein the geometry of space is subject to variations in the dynamic relations of matter.

Of greatest significance, for our purpose, in the new developments in the physical sciences is the emphasis on structure. In Bohr's atomic model the most important aspect is the structure of the field—the orbits or levels of energy.* It is these which condition the activity of the atom—its absorption and radiation of energy. These levels are spaced according to integral quantum numbers. In the later developments of the conception of the atom, the emphasis is on the structural field with its harmonics of consonances and dissonances. Nature takes on the structure of music. Events in nature, when they happen, are predetermined in form by the structure of the parts and their relation to the whole. It is empirically established that the electron, however conceived, carries the same charge everywhere, "even after an

* Insofar as the wave aspect symbolizes the structure aspect of nature, it is thoroughly attested by evidence. This remains fundamental even if it should turn out that a stream of particles can produce interference.

indefinitely long time." On the basis of chance it is infinitely improbable that the constituents of matter and the unit of action, the quantum (even more fundamental), should thus repeat themselves everywhere and always. Such repetition can be understood only on the assumption of an adjustment to a cosmic control or as H. Weyl calls it "a world curvature, which arises from the metrical field according to a complicated mathematical law."[28] The elementary constituents of nature and their cadences are measured in terms of cosmic control.

The harmonics of the combination of these elements into a structural series of atoms must likewise be determined by cosmic control. The spectral lines of atoms are repeated everywhere and so we can tell the material constitution of a star. It is incredible on the probability of chance that the structures of atoms should be repeated everywhere in the cosmos, as the spectroscope shows that they are. The combination of atoms into more complex structures such as molecules, crystals, organic things must likewise be predetermined in its harmonics by cosmic adjustment. Finally, we find that this control is forward-looking, having reference to future development in a particular history, such as the history of our earth. This is shown in the law of proportion in the evolution of atoms, those atoms being particularly plentiful which are basic for further development, as shown in the great abundance of the three elements, carbon, oxygen and hydrogen, which make possible the compounds of water and carbon dioxide, which in turn play such an important part in the development of life.

It is certain that the mechanistic conception of reality is passing and that a new view of reality is emerging, in which structure and wholeness are recognized as present everywhere from the humblest to the highest levels of which our mind is capable of taking cognizance. There are two great streams of tradition in western thought—mechanism, going back to Leucippus and expressed in immortal poetry by Lucretius, and idealism, the fountain head of which is Plato. The tradition of Leucippus has been triumphant in modern science until the twentieth century. It found its classical expression in the eighteenth century ma-

terialists and under the influence of Darwin has taken on the present guise of emergent materialism. But as physics led the way in the Renaissance in rehabilitating and establishing the conception of mechanism, so physics in the twentieth century is leading the way, in a new intellectual renaissance, in the emancipation from mechanism and the discovery of form or structure as fundamental in reality. The tradition of Plato is triumphing over that of Leucippus, though not without recognition of the claims of the latter. Leucippus and Plato express the great poles of thought. The rest is variations. We may say that Plato is the father of the organic conception of reality, while Leucippus is the father of the mechanistic conception. Leucippus emphasized events, Plato emphasized structure. Leucippus emphasized the bricks, Plato the architecture of nature; and we have found that the bricks cannot be understood without reference to the architecture of nature; the nature of the bricks depends upon the architecture as well as the nature of the architecture upon the bricks. This is the age of architecture, in science as well as in art.

In our brief survey of the history of the physical sciences we have seen that emergence has become increasingly recognized as characteristic of nature, but it is not mere chance emergence without any control in nature. It is emergence with structure. Nature is not a mere random collection of parts, but a whole-making activity is manifest in nature. And so physics has come to establish what I have been maintaining in metaphysics, viz. that structure is a fundamental aspect of nature. I have emphasized the experimental results rather than the complicated mathematical theories, which are unintelligible to the layman. But mathematics after all is only language. Its value lies in symbolizing the experimental results; and it must express in some way the duality aspect, indicated in these results. Schrödinger rationalizes these results as wave-mechanics; Heisenberg's interpretation emphasizes the particle aspect and regards the waves as statistical averages. But the important thing is that for purposes of scientific prediction, the mathematical equations of Schrödinger and Heisenberg are equivalent. Eddington speaks

of the equations as "a dodge", but it is rather the rationalization which is a dodge. The mathematics must symbolize the experimental facts in order to work, and facts are more to be trusted than rationalizations and will furnish a challenge to mathematicians to express them with greater simplicity and adequacy. We are concerned primarily with the experimental facts.

Chapter 5

EMERGENCE AND STRUCTURE IN SCIENCE

Emergence in Biology

If we assume the "laws of nature", i.e., the general structure of the universe as depicted by the physical sciences, then the question arises: Can we account for everything in the advance of nature as increasing complexity of the type with which physics and chemistry have dealt? Or do we require new levels of order which transcend those of the material world and which involve new categories? We are familiar with emergence of increasing complexity in the physical world. The electrons combine into atomic patterns with whole-properties of their own, which cannot be predicated of the constituent electrons. Again the atoms combine into molecules which have a structure of their own with unique emergent whole-characteristics which are different from those of the constituent atoms. The molecules in turn combine into molar structures such as crystals of various sorts with their emergent characteristics. We have assumed that, throughout this material hierarchy, we can track the same factors and use the same laws of combination. Is there any limit to this process? Can we account for the whole of evolution, as we know it, in terms of the categories of physics and chemistry? Or must we postulate new levels, with new categories, to account for the advance of nature?

If we use the concept of level to signify an emergence into wholes of greater complexity, then we have an indefinite number of levels and the term becomes too vague to have any descriptive value. We must restrict the concept of level to such qualitative discontinuities as require a new postulate or set of postulates, whether a new element or new laws of synthesis, or both. Are there new levels in this sense? It has been the custom to take a certain kind of organization at a maximum and to contrast it with other kinds of organization, also taken at a maximum. On this basis we speak of matter, life, mind as levels. But if we take

these supposed levels genetically, the distinctions are by no means so clear. If we use matter to mean inorganic matter, we have seen that it represents an order of increasing complexity with new emergent characteristics. The same holds true of life. We are apt to think of life in terms of its two ramifications of plant and animal, the former being especially adapted for the storage of energy, the latter for converting energy into motion. But there are primitive one-celled organisms like the chlamydomonas, now existing, which "could not readily be classed as either plants or animals. Among these primitive organisms appeared some which possessing cholorophyll and a cell-wall became ancestors of more complex plants. Others lacking a cell-wall and chlorophyll became the ancestors of more complex animals."[29] E. J. Allen thinks "that the first organism was of the animal sort but that it gradually grew a tail or whip that enabled it to rise to the sunny surface of the sea whenever it sank below and that it there acquired the chlorophyll by which it could make its own food out of the air and the water."[30] But it does not matter whether we call this simpler form animal or neutral.*

Perhaps we must look to bacteria for the most primitive type of existing organisms. We know that bacteria are capable of developing in a purely mineral medium. We find them in the sea, in mineral springs and in soils. They have left the evidence of their early activity in extensive deposits of sulphur, iron ore, gypsum and limestone. There appear to be bacterial forms of life or, at any rate, bacterial stages of life which are simpler in structure than the cell, with its nucleus, cytoplasm and plasma membrane. Filterable viruses have appeared to be such organisms.[31] But it has now been demonstrated that the filterable virus is only a state in the cycle of such organisms. It has been shown by Kendall that the filterable organism may be changed to a non-filterable state by cultivation in a suitable medium.[32] It has

* The myxomycetes, or slime molds, "are creatures so far down the evolutionary ladder that it has never been decided definitely whether they are plants or animals. They have some of the characteristics of either." *Science—Supplement*, Vol. 77, p. 8.

proved difficult to ascertain the characteristics of such an organism in the filterable state. From experiments on haemolytic streptococci which cause diseases as various as scarlet fever, erysipelas, pneumonia, heart disease, etc., it appears that "these particular bacteria have such inherent powers of adaptation to their chemical environment that the very methods used for discrimination between forms of different origin may themselves bring change to the characters of the organisms under observation."[88] In Kendall's experiments, the influenza bacteria, when placed in a suitable medium, change from the non-filterable state into mere globules and disappear into the liquid condition, but even so they must have considerable complexity of structure for in a different medium the process can be reversed and they can be observed again as individual bacteria. They must, therefore, be far from the simplest living compounds which originated, somehow, in the history of the earth.

We do not know how life originated in the evolution of the earth. Arrhenius used his great scientific knowledge to make plausible the hypothesis that life in its simplest forms might be disseminated from one part to another in the cosmos. It might adhere to particles of dust which might be driven outside of gravitational control and be propelled by light rays through cosmic space. We know that the lower forms of life have a wide range of adaptation to temperature. Some forms of bacteria have survived temperatures lower than liquid air, and algae have been found living in craters of volcanoes at a temperature of 200 degrees F. above zero. If protected from too rapid respiration, bacteria might survive the temperature of cosmic space for a considerable time. But the distances of cosmic space are enormous and it is difficult to believe that even the hardiest forms of life could survive for the necessary time. The generally accepted view is that life is indigenous to the history of the earth, i.e., it holds to abiogenesis. Before Pasteur the belief in the abiogenesis of simpler forms of life was general. Lucretius expressed the general attitude in his conviction that worms originate in the mud after rain. He thought that in the youth of the earth higher forms of life might have originated spontaneously. Care-

ful experiments have disproved the old belief in abiogenesis. Biologists, however, have not given up the idea that some simple form of life must thus have originated in the chemistry of nature, though the conditions for such synthesis in nature may no longer be present.

Science has had remarkable success in synthesizing substitutes for organic products *in vito,* i.e., for natural organic products. But this does not mean that the artificial products are identical with the organic products of nature. It has been found that synthetic vinegar lacks the vitamin D which is so important in preventing rickets. The problem is to synthesize a living compound in the laboratory; and so far the efforts in this direction have been doubtful. In his careful survey of the subject, Spoehr says: "When the theories which have been advanced are studied critically, the conclusion cannot be escaped that, up to the present time, none of these theories has found substantiation on the basis of experimental facts."[84] Spoehr suggests that the difficulty may lie, "not so much in the first steps, the reduction of carbon dioxide, but in the removal of reduction products", known to be present in photosynthesis *in vito.*

The leading idea has been that there are intermediate stages in the process. "Liebig's theory that the organic acids are intermediate products in the synthesis of carbohydrates has in the course of years reappeared with slight modifications of Liebig's original ideas. At this time may be mentioned the theories with formic acid as a first reduction product."[85] According to Spoehr "the various attempts to describe the steps have usually included one of the following forms: (1) a formulation of the theoretical steps from carbon dioxide and water to glucose. (2) Attempts to find, in the plant, substances which form the intermediate steps demanded by the theory. (3) The feeding to the plant of these intermediate products with the object of determining whether the plant is capable of using these substances for the synthesis of sugars or starch. (4) Attempts to effect a photochemical reduction of carbon dioxide *in vitro,* including in some cases the use of chlorophyll preparations."[86] He thinks the subject is still (1926) in a hypothetical stage and that there has

not as yet been given to this subject the patient effort that has been given for example to the establishing of atomic weights.

The problem of discovering the conditions for the synthesis of living compounds from inorganic elements is a fascinating one and will continue to enlist men's efforts. One of the most patient and careful investigators in this field is E. C. C. Baly of Liverpool. He and his collaborators have recently performed two types of experiments on carbonic acid and water. In the first experiment ultra-violet light was used. "When an insoluble powder, capable of adsorbing carbonic acid on its surface, is suspended in water through which is maintained a stream of carbon dioxide, and when the whole is exposed to ultra-violet light, complex organic compounds are synthesized. These may be recovered by evaporation of the solution after removal of the insoluble powder."[37] The following material has been found effective for powders—aluminium powder, barium sulphate, freshly precipitated aluminium hydroxide, and the basic carbonates of aluminium, magnesium and zinc. "The organic compounds thus produced would seem to be of the nature of complex carbohydrates. They char readily when heated alone or with concentrated sulphuric acid."[38] In the other type of experiment photosynthesis was effected by means of visible light. "When carbonic acid, adsorbed on the surface of nickel or cobalt carbonate suspended in water, is exposed to visible light, photosynthesis of organic compounds takes place. One at least of the products of this photosynthesis is a carbohydrate which reduces Benedict's solution, gives the Molisch and Rubner reaction, and forms a solid osazone."[39] In photosynthesis by means of visible light a coloured surface must be used as in photosynthesis in plants, but the colour need not be green.

There is a marked similarity in the synthesis *in vitro,* or artificial synthesis, and the synthesis *in vito* or living synthesis. "Ordinary formaldehyde does not take part in the reaction in either case."[40] A limiting surface is involved in either case. The total yield of organic product corresponds fairly in the two cases. In either case there is a marked fatigue effect with slow recovery. It is suggested that in the leaf there must be some internal

mechanism controlling the rate of photosynthesis. E. C. C. Baly and J. B. Davies, in summing up the results, think that a definite advance has been made towards the solution of the problem of photosynthesis. "Sufficient evidence has already been attained to justify the statement that the similarity between photosynthesis *in vito* and *in vitro* is greater than is implied by the fact that glucose is formed in each case. Then, again, it must be remembered that the compounds obtained in the laboratory are optically inactive, a fact which makes a sharp differentiation between the natural and laboratory processes."[41]

I have given this somewhat detailed account of Baly's experiments to show what the status of the problem is. Nothing comparable with the simplest organism has been attained and there is still "a sharp differentiation between the natural and laboratory processes" even in the attempts to reproduce the simpler organic compounds. It has been suggested that the conception of life as the synthesis of some ten familiar elements may be too simple, and that rarer elements may play a part in the process, perhaps as catalytic agents. "One quarter to one half a part of zinc or of boron per million parts of the solution in which the plant roots grow is frequently enough to insure normal plant growth."[42] Without boron, the plants dwindle. Boron has also been found important in the effective life and function of the chromosomes. The importance of copper for the blood has been recently discovered. It is present effectively in lettuce and wheat seed.

Then there is a theoretical difficulty in theories of the origin of life. What is the simplest organic entity? It must be vastly simpler than the cell. Some have gone so far as to maintain that carbon is organic. In that case the emergence of the organic would mean the emergence of carbon, and no doubt carbon does emerge in the cosmic laboratory. From the point of view of complexity of composition the simplest organic may be less complex than some inorganic compounds. At any rate we can see why some would deny to the emergence of mere organic quality, the dignity of a level. Yet so far the breach between the living and the non-living, while narrowed very much, has not been actually

bridged. There have been philosophers from the Greeks down who have maintained that there is no breach, that nature in every part is animated; and physicists like Eddington seem to incline to this view to-day. Science will doubtless persist in its efforts to close the gap, as nature in some way effects a transition.

But though science should succeed in producing simple living compounds and though it should succeed in following their development to the highest type of life and should give us the complete story of the emergence of intelligence in the life history of the earth, this does not prove that life and intelligence are nothing but an accidental product of weather. Electrons, atoms, molecules, I have tried to show, are not accidents. They are the result of cosmic control, cosmic architecture. Why should not the biologist recognize that the still more selective conditions for the arising of life and for the development of life have reference to the structure of the whole in which the earth's evolution runs its course? If we must postulate a cosmic geometry for the course of stars and the course of electrons, do we not need to postulate a cosmic geometry for the course of life? Is it not reasonable that the evolution of an intelligence which endeavors with some success to understand cosmic structure should take place under the friendly guidance of a cosmos which has the structure of intelligence? Even if we should succeed in fulfilling the cosmic conditions for the arising of the simpler forms of life, would that prove that life is an accident? What do we do, in producing any results in nature, but work with nature; and, by conforming to the conditions of nature, induce nature to do the work for us? The architecture, whether of an atom, a molecule, a bacterion or a human being is the work of the genius of nature. It is not our doing.

We must, I think, recognize that the appearance of the living organism establishes a distinct level where the categories which have proved effective in the inorganic sciences will not suffice. In the language of Niels Bohr: "The existence of life must be considered as an elementary fact that cannot be explained, but must be taken as a starting point in biology, in a similar way as the quantum of action, which appears as an irrational element

from the point of view of classical mechanical physics, taken together with the existence of the elementary particles, forms the foundation of atomic physics." This does not mean that we leave physics and chemistry behind, but it does mean that they come to have a new meaning. The physical and chemical relations of the organism to its environment, and of the parts of the organism to one another, are not the same as the relations within the inorganic world. New principles of distribution of energy must be added where life plays a part. An organism is a self-maintaining unit in a sense that an inorganic compound is not. It has modes of control of energy exchange, of restitution of parts and of self-perpetuation which are characteristic of itself, even though analogies may be found in the inorganic world. In short it is distinguished from the inorganic by a peculiar type of whole-functioning which must be understood in terms of life itself. It has been thought by some that the new physics obliterates the distinction between the living and the not-living. The minute structures of matter, such as electrons and atoms, are indeed active entities. They are no longer conceived as inert. They exhibit a strange degree of spontaneity and indeterminacy. But that does not mean that they are alive in the organic sense. Bohr has pointed out that the experimental procedure of quantum physics is not suitable to living things. If we should try to examine living tissue by the methods of quantum physics, we would kill the tissue. At any rate quantum physics could throw no light on the peculiar organization of life which accounts for its characteristics. To call any entity, capable of action and reaction, an organism, as Whitehead does, is merely to produce a confusion in language.

It has been said that the physicists are transcendentalists while the biologists are materialists. To this, neither physicists nor biologists might subscribe. But biology is still largely dominated by the mechanical model of the seventeenth century, while physics has emancipated itself from it. According to orthodox Darwinism the evolution of life can be written in terms of accidental variations and natural selection. The variations have been supposed to take place within the germ-plasm from the combina-

tion of factors therein contained. The factors and their combination have been supposed to be independent of their environment, whether the body environment or the external environment. (We may take Johanssen as representing the orthodox view). Considering the multitude of factors in the germ-plasm, it does not seem unreasonable, according to this view, that the variations, which we find, could take place by spontaneous combinations amongst these factors. Natural selection then acts upon the result, i.e., some variations succeed in surviving and those transmit their variations to their descendants. These variations are on the whole small but cumulative. Whether they are small or large is a matter of minor importance. The important thing is that the variations and their cumulation are supposed to take place independently of their environment.

The hypothesis of complete isolation of the germ-plasm is too improbable to be taken seriously. Theoretically the factors within the germ plasm should reach an equilibrium, and there is no reason to suppose that they would, in isolation, give rise to variations. This requires energy from outside the system. Furthermore it is inconceivable how there could be cumulative adaptation to the environment if the germ-plasm is independent of the environment. The evidence shows that the adaptation to environment is far too regular to be accounted for by chance. One of the greatest living representatives of the mechanical hypothesis, Thomas Hunt Morgan, while holding in the main to the classical theory, does not dispute that energies in the environment can affect the germ-plasm, though he thinks the effect is general. His insistence is that the external environment must affect the germ-plasm directly and that there is no conclusive evidence that it can affect the germ-plasm indirectly, i.e., through changes in the body cells. Charles M. Child has still further stressed the environment: "Life as we see it, particularly in the higher animals and man, is a series of excitations with the resulting equilibration of the organic mechanisms to the exciting changes. . . . Many excitations are obviously only indirectly related to an external factor, but we have at present nothing to indicate that protoplasm is fundamentally capable of self-

excitation in the strict sense. . . . It is unquestionably true that the excitability of protoplasm constitutes the primary factor in the behavior of organisms in the broadest sense."[43]

Biology has developed the most thoroughgoing mechanistic hypothesis in modern times. The development of this hypothesis is in large part due to the recovery of Mendel's papers in 1900, though the speculative foundations were laid by Weismann. Mendel's experiments are too well known to need detailed statement. He found relief from his duties as the abbot of a monastery by experimenting with peas and sweet peas in his garden. In one experiment "he crossed a tall variety of edible pea to a short variety. The offspring or hybrids were allowed to self-fertilize. The resulting offspring were tall and short in the ratio of three tall peas to one short. If the tall variety contains in its germ-cells something that makes the plants tall, and if the short variety carries something in its germ-cells that makes the plants short, the hybrid contains both; and since the hybrid is tall it is evident that when both are brought together the tall dominates the short, or, conversely, short is recessive to tall."[44] The ratio of three to one is easily understood if we keep in mind that the tall character is supposed to be dominant. If we suppose, as Mendel did, that there are different factors in the germ-cells for different characters, we can see that, in chance fertilization, when the factor for tall meets the factor for tall a tall plant should be produced, when the factor for tall meets the factor for short a tall plant should be produced, since the factor for tall is dominant and that for short recessive; and when the factor for short meets the factor for a short a short plant should be produced. With two kinds of factors there would be just four possibilities. And the experiments show that one tall specimen is pure, the other two tall specimens are blends; and of course the short specimen is pure. Another illustration is furnished by experiments with white and red sweet peas, precaution being taken of course that the original specimens are pure. Here red proves to be dominant, so in the first hybrid generation all the specimens are red; and in the second inbred generation, three on the average are red to one white, and so on. Of course, plants

have several characters and the other characters vary too in the same way in the process of cross-breeding.

Mendel assumed that the factors for the characters are permanent in the germ-cells and act independently of one another. If this is the case, it should be possible to reverse the process and to separate the characters in the blend. This seems to be indicated in the experiments. "Mendel put his hypothesis to a simple test. The hybrid was back-crossed to the recessive type. If the hybrids are of two kinds, tall and short, there should be two kinds of offspring, tall and short in equal numbers. The results confirm the expectation."[45] In the experiment with red and white sweet peas, the white comes back white even though it was dominated by red in the blends. Even more striking is the instance of crossing red and white four-o'clocks. Here the result is pink. But, in the process of crossing, the red and white are recovered, neither being tinted by the other. In one respect Mendel's hypothesis had to be modified. Not all the characters vary independently, as Mendel supposed. Some characters are linked and have to be treated as inseparable in the various assortments.

The work of Mendel has been tested and amplified by different experimenters. Especially notable are Morgan's experiments with the common fruit-fly. Mendel's physical basis for characters is now christened gene—evidently with a squint at the Arabian Nights. And the gene is a truly marvelous entity in the mind of the geneticists. If, instead of a pair, you take all the characters involved in cross-fertilization, it is possible to take account of the frequency of crossing over of characters in the germ-plasm and to establish series on the basis of distance or proximity of the genes. "The frequency of crossing-over furnishes evidence of the linear order of the elements with respect to each other."[46] Thus an attempt has been made "to handle problems of genetics on a strictly numerical basis, and allow us to predict, with a great deal of precision, what will occur in any given situation."[47] The behavior of the organism can thus be explained through the collective action of the genes.

The hereditary elements which Mendel conceived as the physical basis of characters were purely hypothetical. But geneticists

have tried to discover visual evidence for these elements. "The study of the changes that take place during the final stages in the maturation of the egg and sperm cell have revealed a remarkable series of events that go far toward furnishing a mechanism of heredity."[48] During the process of fertilization certain characters in the germ cells take stain and can be photographed. These characters are called chromosomes. A great deal of attention has been paid to the tracking of these characters during the distribution of the material of the germ cells in fertilization up to the final stage, the state of maturation. "It was discovered that there is a double set of chromosomes in each cell of the body and in the early stages of the germ-cells. The evidence of this duality comes from observations on differences in the sizes of the chromosomes. Whenever recognizable differences exist, there are two chromosomes of each kind in the somatic cells and one of each kind in the germ cells after maturation. One member of each kind has been shown to come from the father and the other from the mother. . . . The only striking exception to the rule is sometimes found in the sex-chromosomes but even here the duality holds for one sex, and often for both. . . . Toward the end of the ripening period of the germ-cells, chromosomes of the same size come together in pairs. This is followed by a division of the cell, when the members of each pair go into opposite cells. Each mature germ-cell comes to contain only one set of chromosomes."[49] This separation is called "reduction."

It is supposed that on separation there is a pairing of a maternal chromosome and a paternal chromosome. But since the pairing chromosomes are ordinarily alike in shape and size it is not possible under such circumstances to distinguish the paternal from the maternal member. It was found, however, that in grasshoppers there is a slight difference. They can therefore be traced to the poles; and "there is in the male, an unpaired member that is connected with sex determination."[50] Furthermore "a study of these chromosome pairs at reduction has shown, again, a random distribution of the members of the pairs with respect to one another. Here then we have objective evidence of the independent assortment of the pairs of chro-

mosomes. This evidence parallels Mendel's second law, which calls for independent assortment of the members of different linkage groups.''[51] An effort has been made to associate the linkage of chromosomes with the linkage of Mendelian characters. This means the establishment of a definite number of linkage groups of chromosomes as well as of characters. In the red fly Morgan finds that there are only four such groups of linked characters and there are four pairs of chromosomes. But this analogy has not been established except in a few instances.

There are of course difficulties in the chromosome hypothesis. In the simplest organisms it is not possible to identify chromosomes. In the protozoa, the ordinary process of reproduction is by spontaneous division; and even when there is cross fertilization the process is transient and difficult to follow. In the higher organisms, there has been considerable uncertainty about the number of chromosomes, though this uncertainty has been very much reduced. There is difficulty, moreover, in establishing the substantial identity of chromosomes in the history of the individual. ''There is general agreement amongst cytologists that when the chromosomes are set free in the protoplasm they remain intact through the entire period of cell division, but when they take up fluid and combine to form the resting nucleus, it is no longer possible to trace their history. By indirect means, however, it has been possible to get some evidence as to the conditions of the chromosomes in the resting stages. After each division the individual chromosomes become vacuolated as they come together to form a new resting nucleus. They can be followed for some time, forming separate compartments of the single nucleus that reforms. They then lose their staining quality and can no longer be identified. When the chromosomes are again about to appear, sac-like bodies are seen. This suggests, if it does not prove, that the chromosomes have remained in place during the resting stage.''[52] This is perhaps a matter of bias. They may be emergents in the process. J. McA. Kater maintains the chromosomal continuity through the resting stage in studies of the frog, the rat, the common bean, etc. The linen sheath, he thinks, takes

the place of the individual chromosome in the course of the cycle, and furnishes continuity, though obscured for a time by overlaying matter. "The linen sheath of the chromosomes becomes visible in conjunction with the telephosic vesiculation and can be followed through interkinesis thus showing that this unit of nuclear structure maintains its individuality during rest."[53] Kater thinks the linen sheaths contain the chromosomes like so many buckshots. But even if it were possible to establish some sort of continuity of the chromosomes from one reproductive state to another, they certainly go through a cycle and this cycle is determined by the energy system of which they are a part. And it is to this energy system that we must look for the ultimate control. The sorting of the chromosomes which is involved in the process of reduction cannot be the work of the chromosomes themselves. It must involve the whole energy system with its control. Since it is precise, it cannot be the work of chance. Do the chromosomes, perhaps, hold a council and agree to a separation? The mechanical model is too simple even to account for itself.

The significance of the chromosomes for the mechanical theory is to furnish a visible home for the genes, which are conceived as the real determiners of heredity. It has already been emphasized that in bisexual reproduction the male and the female contribute equally to the history of the individual, though the dominance of the female element is apparent in the early stages. "In animals, the male contributes, as a rule, only the head of the spermatozoön, which contains almost exclusively the nucleus composed of the condensed chromosomes."[54] But is has been shown that visible elements of protoplasm, the centrosomes, may also enter with the sperm and it is not known what they contribute. When two (or more) sperms enter the egg, four instead of two cells may result from the first division. It is maintained that "normal development does not take place unless at least one full set of chromosomes is present," though since "the chromosomes are not marked, the evidence does not do more than create a presumption that at least one set of chromosomes must be present."[55]

As further evidence for the chromosome hypothesis it is alleged that the chromosome number is, as a rule, constant in the species. But, aside from the difficulty of counting the chromosomes, we know that there are variations. Sometimes there are only half the number. In such cases, it is held that the offspring are not so vigorous, but that is not true of mosses. When the number is double or triploid, no essential difference is supposed to take place, since the genes bear the same ratio to one another. The greater problem is when there is a difference of one or two chromosomes. In such cases, Morgan thinks it is possible to trace defects in the offspring. But X-ray experiments have shown that the number and arrangement of chromosomes may be disturbed to a considerable degree without any marked differences of productivity and vigor of the offspring. It is not maintained that if the chromosome number remains constant, therefore, the genes must maintain an invariable relation. They may vary in arrangement within the chromosome and as between chromosomes. This assumption is made necessary by the facts of variation when the chromosomes are constant.

The genes are ultra-microscopic.[184] They are assumed in order to account for functions. Morgan has calculated that the gene may be of the dimensions of an organic molecule. It is supposed in any case to be a chemical entity of some sort. Do genes disappear? Do new genes originate in phylogenetic evolution? Morgan does not think it necessary to assume that, because many mutations are defective, there is a loss of the corresponding gene. He is also prejudiced against the idea that genes originate independently. "At present we find no need of interpolating new genes in the linkage series, or at the end of the series. If the same number of genes is present in a white blood corpuscle as in all other cells of the body that constitutes a mammal, and if the former makes only an amoeba-like cell and the rest collectively a man, it scarcely seems necessary to postulate fewer genes for an amoeba or more for a man."[66] But a white blood corpuscle is not an amoeba. And what becomes of the relation of genes to chromosomes? In general the logic of

genetics would seem to be anti-evolutionistic; and it is not surprising that one distinguished geneticist, Heribert Nilsson, should have thrown the theory of evolution overboard. If Mendel had been conscious of evolution, he might well have used his evidence against evolution. But most geneticists with Morgan admit change in genes (if not new genes) in the case of mutations.

It would be a mistake to suppose that, in its new development, the mechanical hypothesis takes no account of the influence of environment in the development of the organism. But variations which the environment produces in the somatic characteristics are not supposed to affect heredity. In Morgan's experiments with the fruit-fly, a race appeared with abnormal abdomen, "in which the regular banding of the abdomen is more or less obliterated. This condition, in its most extreme form, appears in the first flies that emerge from a culture when the food is abundant and the culture is moist and acid. As the culture gets older and drier, the flies that emerge become more and more normal in appearance, until at last they cannot be distinguished from wild flies."[57] If we breed under the same conditions, the same characters appear—the flies with abnormal abdomen breed flies with the same kind of abnormal abdomen. But under changed conditions, the flies return to normalcy. This experiment has been repeated for a succession of ten generations. The same experiment has been tried with a mutant stock of fruit-flies called eyeless. "The eyes are smaller than the normal eye and very variable. By selection, a uniform stock has been produced in which most of the flies are without eyes, but, as each culture gets older, more and more flies have eyes, and larger ones."[58] If these late-hatched flies with eyes are bred under the same conditions as the eyeless ones, they produce the same sort of offspring as when the eyeless flies are used. Here we have variability of characters with the medium. There is, according to Jennings, a salamander in Mexico which when bred in one environment is characterized by "a heavy broad body, a tail flattened for swimming and external gills"; in another environment it takes the form of a land animal, breathing air. In the

same environment it breeds true. Morgan regards the "normal" characteristics as permanent in the germ-plasm; but if the "abnormal" characteristics depend upon the specific environment, it is difficult to see why the "normal" characteristics do not also depend upon their specific environment.

Jennings is more explicit about the rôle of the environment. "Characteristics are not inherited at all; what one inherits is certain materials that under certain conditions will produce a particular characteristic; if these conditions are not supplied, some other characteristic is produced."[59] We must, therefore, take account of conditions in our interpretation of heredity. "The genes then are simple chemicals that enter into a great number of complex reactions, the final upshot of which is to produce the completed body. The characters of the adult are no more present in the germ-cells than is an automobile in the metallic ores out of which it is manufactured. To get the complete, normally acting organism, the proper materials are essential; but equally essential is it that they should interact properly with each other and with other things. *And the way they interact and what they produce depends on conditions.*"[60] In this interaction, the cytoplasm, the protoplasmic part of the cell, must be taken account of, as well as the genes. Every resultant cell in the cell-division is supposed to continue the entire set of genes. The difference, therefore, in the diverse cells of the body cannot be in the genes which they contain but must be in the remaining part of the cells, the cytoplasm. These differentiations have been produced by the interaction of the genes with the cytoplasm. It is in this way that the complex adult body with its typical pattern of structures is supposed to be produced. Having reference, then, to the development of the organism in its environment, we may say that "all characters are as certainly due to conditions of development as to the materials of the germ-cells."[61] On this basis, Jennings scouts the idea that races and stocks of human beings are necessarily what they are on the basis of heredity. He seems to advocate a doctrine of emergence of characters.

On closer scrutiny, however, it does not seem that Jennings

holds to the emergence of characters in the process of interaction of the germ-plasm with the environment, but rather inclines to the view that "every individual has many sets of 'innate' or 'hereditary' characters; the conditions under which he develops determines which set he shall bring forth."[62] In this broad sense, he thinks we may regard cultural characteristics as inherited. The characters are elicited or precipitated rather than emergent in the process of interaction with the environment. The mechanical conception still remains. This comes out clearly when he comes to the causal explanation of characters. Here the genes are the determiners. This does not mean that an individual gene determines an individual character. Genes, rather, act in chains. Altering one gene may indeed alter a character, but that does not mean that a gene acts singly. A number of genes are involved in producing a single character while, again, one gene in its interrelation with other genes is involved in the producing of a number of characters. The result of Jenning's analysis leaves us with the mechanical model and its problems. The determiners are invariant in the germ-plasm, however important the process of interaction may be in bringing into play a certain set.

Selection plays a much smaller rôle in present biological theory than it did with Darwin, though it is still regarded as a principle. "Today we regard the selection process, whether natural or artificial, as capable, at most, of causing changes only to the extent to which recombination of the genes already present may affect a change; or, in other words, selection cannot cause a group (species) to transcend the extreme variations that it naturally shows."[63] Darwin recognized that selection must work on the grist of variations. But on the Mendelian theory most of the variations are of a temporary nature. Those due to crossing will tend to revert to pure stocks. The fluctuations which are due to individual history occur again under similar conditions, but they are not inherited. Only mutations, or changes in the genes, are supposed to be inherited; and these are much rarer in nature than Darwin thought.

The mechanists have, at any rate, been forced to abandon

the extreme position that the germ-plasm is isolated from the environment. The evidence, under controlled conditions, by means of radium, X-rays and other stimuli is conclusive that changes in the germ-plasm can be effected through external energies. Little and Bagg have carried out a series of experiments to determine the effects of radium on pregnant mice and rats. Many of the embryos and offspring died. But of those that survived many showed "serious defects in the brain or in the appendages. One or both eyes may be defective. Both eyes may be absent, or one only may be present, much reduced in size. Bagg has bred some of these mice and finds that they produce many abnormal offspring that show defects similar, in a general way, to those induced directly in the original embryos."[64] It has been known for some time that various inheritable abnormalities result from treatment of plants and animals by X-rays. Until recently experimenters have merely noted such abnormalities in an incidental way. But in the last few years experiments with X-rays have taken on new importance. H. J. Muller has subjected the sex cells of the common fruit fly to X-rays and has produced a large number of variations in external appearance in the progeny. These variations have been proved to be inherited through successive generations.[65] The fruit fly presents many advantages for experimentation; and not the least of these is that as many as twenty-five generations can be produced in a single year. It is therefore easy to test whether variations are inherited.

An experiment of more obvious practical consequence to the human race is that of T. H. Goodspeed and A. R. Olson, on the common tobacco plant. These experimenters used X-ray treatment on the seeds (in later experiments on the pollen) of *Nicotiana tabacum*. Many of the seeds were killed, but those that survived presented variations far in excess of those that occur in the natural process. Some of these seeds were sterile, but of those that were fertile new generations were produced, and it has now been established that the variations are inherited.[66] Some of these variations are not only normal but superior in productiveness to the original seeds. The success of this experi-

ment is likely to lead to a revolution in methods of improving seeds, not only in tobacco plants but in other plants. People addicted to the use of tobacco will rejoice in the prospect of bigger and better tobacco plants.

The above experiments have to do with mutations induced by the artificial treatment of the germ-plasm. The X-ray treatment has been called the buck shot method. The charge causes a rearrangement within the germ-plasm. The experimenters speak of it as an acceleration of the natural process. In classical terminology it would still be a question whether such a change means the emergence of new genes or the modification of genes or merely the rearrangement of genes. Morgan in his classical experiment on fruit flies (which in the earlier experiments, had first been treated with X-rays) admits the possibility of the modification of genes, but does not think there is emergence of new genes. Since genes are hypothetical entities, invented in the service of description, there is nothing to prevent us from readjusting our conception of them as the facts may seem to require. Morgan insists, however, that the heritable variations must be produced by the direct action of the external energies on the germ-plasm and that the effects are general.

We have seen that, in Little and Bagg's X-ray experiments with mice, "the offspring often show serious defects in the brain or in the appendages. One or both eyes may be defective. Both eyes may be absent, or only one may be present, much reduced in size." Morgan asks: "How shall we interpret these experiments? Has the radium first produced its effects on the brain of the developing embryo, causing defects, and is it owing to the presence of these defects that the germ-cells of the same embryo become affected. There is an apparent objection to this interpretation. We should expect, when the brain alone is affected, that the next generation should show brain defects; when the eye is the principal organ affected, the next generation should show only eye defects. So far as reported, the results are not like this, for a mouse with abnormal brain and full-sized eyes may produce offspring that have defective eyes. In other words, there is not here a specific effect but a general one."[67] This rea-

soning is not conclusive owing to the close relation between the brain and the eyes. Defectiveness in the brain might well cause defects in vision and these defects might appear in a later generation. But it is difficult to devise an experiment which will exclude the possibility of direct action. Many experiments have been reported as pointing to indirect action but none of them has gained general acceptance. With superior technique and control, science may be able to supply an experimental test as to whether somatic changes can produce heritable variations.

No doubt, to be inherited, in the true sense, a modification must somehow get into the germ-plasm But it is not necessary to suppose that the action on the germ-plasm must always be direct. In the long ages, the external environment must have affected the germ-plasm through acting upon the surface of the organism. It is difficult otherwise to account for such adaptive organizations as the sense organs. In the unicellular organisms we can observe the action of light upon the surface of the organism, and in C. A. Kofoid's beautiful experiment upon the Unarmored Dinoflagellata we can watch the stages of internal reorganization until a black spot appears upon the surface.[68] But in the more complex multicellular organisms we cannot thus watch the readjustment. The effect is veiled in the complexity. It might be maintained that the environment really acted directly on the germ-plasm at an early stage of evolution and that the modifications cumulated there in the course of evolution, until they were perfected and showed themselves in the appropriate adaptive structures. But this does not seem probable in view of the complexity of the adjustment and the variety of ways in which it has been accomplished. The action from the external environment must have been a factor in the emergence of the appropriate mechanisms of adaptation. These cannot be accounted for as the result of chance variation independently of the environment. We know that the action of light does not stop with the surface in the more complex animals, any more than in the amoeba. The vibrations are taken up by the organism which responds with its own characteristic rhythm. Light does not produce an eye by direct action on the surface, but it stimulates

the proper organism to a creative process of adaptation which in the long ages results in the organ of the eye.

The paleontologists have generally inclined to the general Lamarckian principle that the reactions of life to external conditions in the long ages affect structure. And they have the advantage of the experimentalist in a long perspective in which they can note the gradual changes. In a broad way, the pulse of life varies with the pulse of the earth of which it is a part, as Lull[69] has shown. This must be true on the negative side since the variation of climate with geological elevation establishes new survival conditions, but it also seems to be true in the way of accelerating the pulse of life, in the way of more rapid mutations. In the latest great rise of the earth's crust, man appeared; and the crust is still rising, with accelerated speed of human civilization.

The Lamarckian hypothesis that action of life on the environment is a factor in the racial development of appropriate organs has been violently opposed by those who hold to the mechanistic hypothesis of heredity. Weismann thought he disproved it by cutting off the tails of several generations of mice. But this can scarcely be regarded as action initiated by the mice to realize a life impulse. Experimental methods cannot be said to have succeeded so far either in proof or disproof. But paleontological evidence may be of greater value. D. M. S. Watson points out that the evolutionary changes in structure "may be, and perhaps generally are, such as to produce mechanical fitness for the animals considered.'"[70] H. F. Osborn maintains the influence of bodily locomotion in changing the proportions of arms and legs relatively to the body and in altering the characteristics of hands and feet in human development from the arboreal to the terrestrial mode of life.[71] If the physicist and chemist feel compelled to assume something analogous to psychology in order to account for the behavior of electrons and atoms, there seems far greater reason for believing that psychology cannot be excluded from a real account of the basis of life. The paleontologists have always maintained that the effort of the organism to live within a changing environment has played an important

part in the evolution of characters and organs which would enable an organism to live.

The mechanical hypothesis furnishes no mechanism of development. It emphasizes end-terms. It notes certain recurrences of characters in the individual, the so-called Mendelian characters, and it assumes that these characters must have corresponding factors in the germ-plasm. In recent developments of genetic theory there has been a tendency to take account of the cytoplasm as well as the nucleus as part of the original mechanism. But even then to say that the development of the individual is due to the collective action of the factors in the original fertilized cell does not tell the whole story. The environment is also a factor. The strict mechanists speak of "abnormal" characteristics as due to an "abnormal" environment. They imply at least that the "normal" characteristics are independent of the "normal" environment. But "normal" environment and "normal" characteristics merely mean usual environment and usual characteristics. The "normal" characteristics have as much reference to their environment as have the so-called "abnormal" characteristics. Both are equally stable in their respective environments. Fish hatched in a magnesium solution develop as naturally into cyclopean individuals, with one eye in the middle of the head, as fish in the usual environment develop two symmetrical eyes. There can be no organism without an environment. The synthesis of a new organism in its life history is as truly a function of the environment as of the hereditary factors. In physics we have learned that to understand the nature and behavior of *the factors* we must take account of the conditions and structure of the field in which the activity takes place. Biology is still based largely upon the old atomic physics. It must adjust itself to the new physics of cosmic structure. As the old mechanical determinism has been discarded in physics, so it must eventually be discarded in biology, for biology leans on physics.

There have not been wanting criticisms of the mechanical model of the geneticists within recent years. A warning has been sounded within the ranks of the experimental geneticists

themselves. The great pioneer in experimental genetics, William Bateson, expressed at the end of his career his scepticism of the methods he had pursued: "We have no clear answer to give. We cannot see how the differentiation into species came about. Variations of many kinds, often considerable, we daily witness, but not origin of species. . . . The claims of natural selection as the chief factor in the determining of species have consequently been discredited." And recently the veteran geneticist, Maurice Caullery, has confessed similar misgivings: "I do not believe," he says, "that mutations and genetical laws are sufficient for evolution, as it is accounted for by morphological and paleontological data."[72] He regards it as "doubtful whether mutations really constitute new developments in the descent of species." They may be "virtually contained and preexisting within the species regarded as stable", while evolution is concerned with new types. The mammal type is not contained within the reptile type, but is a radical departure from it. He points out that the mutations in Morgan's experiments are viable with other so-called species, i.e., can be crossed reproductively without end, while species in nature, even though they differ less markedly, are non-viable. But species is an ambiguous term. He also points out that the experimental mutations are for the most part defects, due to loss of characters. But it is not reasonable to suppose that evolution is due to elimination of characters. Above all, he does not think that fortuitous mutations can account for adaptation. He feels constrained, therefore, to admit that the paleontologists who have looked upon evolution as the interaction of life and environment are on the right track.

Recent experimental evidence seems to support Caullery's suggestion that "the mutations may be virtually contained and preexisting within the species regarded as stable." In recent researches conducted at the Kaiser-Wilhelm Institute for Brain Research in Berlin, it has been shown that the process of producing mutations by means of X-rays can be reversed. Fruit-flies, classic experimental animals in genetics, were used in the research. "Bombardment of their reproductive cells with X-rays caused marked changes in colour, shape, size, etc., of eyes,

wings and other body parts in their offspring. Dr. Timofeeff-Ressovsky discovered that a second bombardment inflicted on these same offspring would often reverse the changes, causing the third generation to have a normal appearance again.''[73] It has been pointed out that catalytic agents, whether internal or external, can accelerate (or sometimes retard) the chemical reactions with which we find them associated. They do not initiate the reactions nor do they account for their type. They cannot, therefore, by themselves explain the synthesis of new structures. But if we mean by mutations all heritable variations, large or small, they must of course figure as part of the process of evolution. The question, then, becomes whether artificially produced mutations throw any light upon the origin of species in nature, or whether they are not rather disturbances in the way of dissociations or accelerations, for the time being, of ''a basic species structure''. The facts indicate that such mutations are heritable and, in the case of the tobacco experiments, that some of the mutations are not only viable but give rise to a superior stock.

One group of critics, the vitalists, have felt that the orderly development of the organism calls for the assumption of an agency of another order from those dealt with by physics and chemistry. The two best known attempts to supply such an agency are those of Bergson[74] and Driesch.[75] Of these attempts, that of Bergson is the more general and the more metaphysical. Bergson assumes that the fundamental reality is life or consciousness. The original vital impulse, the *élan vital,* contains within itself all the potencies of evolution. The material environment furnishes merely the resistance which makes the vital impulse split up, like a sky rocket shot into the air, into its inherent tendencies,—the plant and animal and all the variety of forms which these assume. The energy of the process comes from the vital impulse, and evolution is a process of dissociation. Throughout the process the vital impulse strives to express itself according to its own inherent potentialities. Bergson's vital impulse does provide for a certain spontaneity and initiative on the part of life, but it no more furnishes an account of the process of evolution in the particular environment than does the

mechanical hypothesis. (We might christen the inherent potencies of the vital impulse, genes.) The evidence shows, moreover, that the environment plays a more positive part than Bergson's hypothesis indicates. The vital impulse would have to account for reversals in evolution as well as progressions. It would have to be latent for ages. No account is given of its origin, for life is supposed to be reality, while matter is merely the downward trend of life. But life seems to emerge from matter in the history of the earth.

The hypothesis of Driesch is limited to embryology. He assumes a non-physical factor which he calls entelechy, borrowing the term from Aristotle. He does not feel called upon to account for its origin, for it is neither temporal nor spatial. An entelechy is an "energy-suspending, regulating and organizing vital principle." It is not conceived as a cause in space and time, but it is supposed to provide the order and goal of individual development. It is bound up with the equipotential theory of Driesch, namely that any part, be it part of the original cell or of any cell in the earlier cell division, can develop into a complete organism, showing that the "plan" of an organism is contained in the parts. Driesch supposed that this was shown in his experiments on sea urchins. He emphasized the teleological nature or wholeness of the organism in the restitution of parts and in its individual behavior. But following the tendency at the time he ignored the rôle of the environment, internal and external. In its extreme form the hypothesis has been disproved by experimental evidence. A part of a cell does not, according to the experiments of Boveri, develop into an organism unless the part contains within it the nuclear chromosome structure. And, later in the differentiation, the cells do not possess this omni-competence. A liver cell will develop not an organism, but liver. But the main difficulty with Driesch's entelechy is that in accounting for everything it accounts for nothing.

Vitalism is a protest against the merely mechanical explanation of life, though it is itself scarcely less mechanical. To account for organic development, we no doubt need other categories than those used by the mechanist. But such conceptions

as Driesch's entelechy are too abstract to be of any service. It seems strange when the physicist has found mechanical categories inadequate to account for the behavior of matter and has been forced to introduce new conceptions, suggesting a more fluent and even psychological character, that the biologist should still be working with the old mechanical models. But in time he too must feel the impulse of the new physics. He will then see the significance of Dirac's mysterious formula.

Vitalism has not taken root in biology, but it has stimulated biologists to increased effort in acounting for wholeness of development in terms of the natural process. One approach to the problem has been to view development physiologically instead of mechanically. The difference between the mechanical and the physiological view is that while the former regards the development of the individual as predetermined by the hereditary factors and their arrangement in the nucleus of the fertilized cell, the latter regards the development of pattern and of differentiation of parts as involving the continuous stimulation and guidance by the environment on the one hand, and the interstimulation of parts in the process, on the other. According to C. M. Child, "the fundamental difficulty of the predeterministic conception as regards the organism as a whole lies in the assumption that the unity and order, the 'wholeness' of the individual organism, as well as the hereditary potentialities of the individual, are inherent in the protoplasm. No theory of heredity can account wholly for the individual organism. The individual represents heredity plus environment, in other words, behavior of a particular kind of protoplasm with certain hereditary potentialities, genes, or factors, in a particular environment. This behavior is the agency which orders and unifies the hereditary machinery and constitutes the starting point of the organism as a whole."[76]

There is an organismic pattern and this pattern of the whole is different from, and on a larger scale than, the patterns of the protoplasmic parts which constitute the organism, but the organismic pattern has "no meaning except in relation to environment. It is in fact a pattern which makes it possible first

of all for protoplasm to persist in the external world, and second to modify and control its environment in an increasing degree. In whatever respect we regard the organism, it is obviously in relation to the environment at every point. Mechanisms are all concerned in some way with either the dynamic or material factors of its environment.''[77] The mechanical view is inclined to regard the ''normal'' pattern as inherited, while the modifications are attributed to the action of a special environment. The physiological view regards the distinction between normal and abnormal pattern as relative. Both are to be viewed in their relation to their particular environment. Life is, as Herbert Spencer expressed it, ''the continuous adjustment of internal relations to external relations.'' But when Child says further that ''the organismic pattern, on the one hand, and the specific hereditary constitutions of the protoplasms in which the patterns are expressed, on the other, determine the possibilities, the directions, the range and the complexity of this adjustment'',[78] he shows that he is not thorough-going in his physiological account.

The fact is that Child is interested primarily in the axiate characteristic of organisms, their polarity and symmetry. ''Physiological polarity and symmetry, either radial or bilateral, are commonly thought of as conditions of some sort underlying and determining the localization and arrangement of parts and organs of the individuals, i.e., their spatial, morphological pattern.''[79] Polarity and symmetry are usually interpreted as due to the structure of the germ-plasm. Child, on the other hand, regards these characteristics as due almost altogether to the action of the environment. ''Polarity and symmetry appear to be largely if not wholly independent of the specific constitution, whether molecular or molar, of different protoplasms. Different axes, different axial combinations, and different symmetries may appear in nature or be experimentally determined in a particular protoplasm; and similar polarities and symmetries may exist in very different protoplasms. In axiate organisms, then, as in simpler forms, the factor which determines the order and unity of the individual is apparently a non-specific factor, while the

hereditary constitution of the particular protoplasm determines the specific characteristics of the individual.'"[80]

Polarity and symmetry are for Child axial directions or axial gradations in the growth of an organism. These must be understood functionally. He thinks the evidence shows "that physiological axes are primarily quantitative dynamic gradients, in living protoplasms; that they represent primarily differences in physiological state, rather than in molecular structure. Such gradients involve differences in rate of fundamental metabolic reactions as well as differences in physical state of the protoplasmic substratum. They have been called for convenience, axial, metabolic, or physiological gradients. So far as the facts go, they are the primary indications of the existence of axiate pattern and there is at present no evidence to indicate that axiate pattern can arise in any other way than as a gradient in physiological state.'"[81] A gradient is "a gradation in the rate of cell division, growth, morphogenesis and differentiation." This can be observed in the direction, rate and distribution of growth with reference to light, gravity, electrical stimulation and in other ways. It involves dominance and subordination in the interest of the whole. It is possible to modify the gradation in nature within a considerable range under experimental conditions, with such animals and plants as can be used for such purposes.

The evidence of experimental modification certainly indicates that interaction with the environment is a factor in polarity and symmetry. Child is inclined to minimize the hereditary structural aspect in polarity, if not to ignore it. But not all organisms are axiate in character though the stimuli are always present. Organisms are limited to three fundamental morphological patterns, radial, polar and polarlateral. This limitation must involve the character of the protoplasm since we find no such limitation in crystals. Within the same environment we find a difference in axes in different organisms. In fact all the axial patterns coexist in nature in the same environment. This coexistence cannot be due merely to interaction with the environment, but shows that we must take account of native structure

as well as environment. Different kinds of wholes of different grades of magnitude and complexity coexist and live their life histories within the same environment. It is evident that we cannot attribute this wholeness with its various qualities to physiological functioning alone. We cannot explain the life process, if we make a bifurcation of heredity and environment.

Furthermore, it is artificial and untrue to evidence to attribute axial differences to the action of the environment, while attributing specific characters to the structure of the protoplasm. Both axial gradations and specific characters vary with different environments. Both are permanent for successive generations in relation to the same environment. Whether in the interrelation of cells within the organism or in the interrelation of individuals within the group, animal or human, we must take account of the structure of the whole and of the interacting parts, as well as of stimulation and response. In either case, the same stimulus may produce a different response, and different stimuli may produce the same response, in accordance with the difference or sameness of structure of the parts which interact. The important thing to keep in mind is that the individual without the environment is an abstraction and that the characteristics of the individual, whether axial characteristics or special characters, emerge in the interaction of the individual with the environment. Structure must not be conceived as static structure but as dynamic forward-looking structure. The effect of such interaction upon heredity is another story. To affect heredity the germ-plasm would have to be affected in some way, whether directly or indirectly.

For the most part, theories of individual genesis have stressed the end-terms. Some have stressed the original structure of the germ-plasm; others have stressed the controlling action of the environment. S. J. Holmes represents a tendency among recent geneticists to stress the interaction of cells in the process of development as the principal factor in form regulation. His theory, he tells us, "is essentially epigenetic, and attributes differentiation not to a highly organized initial structure, nor to a multitude of different representative particles; but all form-

changes are regarded as a result of interaction.''[82] One cannot help being impressed with "the resourcefulness of organisms in attaining and regaining their normal form." A theory of development must account for this fact. The adjustment of a machine comes from without. But in the case of an organism it comes from within the process itself. "It is perfectly plain that organisms must possess some power of regulation so that departures from the norm automatically bring about their own check. . . . Organisms can be thrown off the track of normal development in a thousand ways, yet instead of continuing to become more abnormal they get back sooner or later upon the right path. And their ways of getting back are multitudinous. If they are prevented from employing one method they frequently use another."

Organs are often regenerated by methods very different from those by which they were formed in embryonic development. In fact "organs arising from one germ layer may at times be regenerated from an entirely different germ layer."[83] This may be illustrated from "experiments on transplanting the optic cup of the developing eye. In the place where the optic cup, which grows out from the brain, comes into contact with the ectoderm of the outer surface there is formed a lens as the result of the transformation of certain ectodermic cells. Later the outer skin forms a transparent cornea in the same position. What causes the lens to form in this place? In order to answer this question the optic cup of a young tadpole was transplanted beneath the skin in another part of the body, and a lens formed where the rim of the cup came in contact with the ectoderm. Any part of the ectoderm apparently has the potency to form a lens, and other experiments showed that any part of the skin could form a cornea."[84] Such a result cannot be accounted for by assuming a special factor in the cell, as Weismann did.

The early epigeneticists tried to solve the problem by assuming a directive force or a formative *nisus* working toward a predetermined end. "Not only," says Harvey, "is there a soul or vital principle present in the vegetative part, but even before this there is inherent mind, foresight and understanding, which,

from the very commencement to the being and formation of the chick, order and take up all things requisite, moulding them in the new being with consummate art into the form and likeness of the parents."[85] But Holmes is averse to any whole-form as guiding the process and tries to account for it instead in terms of the interaction of its parts. What are the external and internal factors which bring about this regulation? There have been various "researches on how the eggs of different forms are influenced by gravity, pressure, temperature, light, electric currents, chemical substances, and changes in osmotic pressure."[86] While Holmes does not deny the influence of mechanical factors, he stresses the principle of Driesch that "the fate of a cell is a function of its position." But position must be understood in connection with interaction. "Position means that certain stimuli are received from the surrounding parts. These we may call formative stimuli, and the differentiation of the part is a consequence of the reactions which these stimuli call forth. An embryonic cell of a complex organism has a large, but nevertheless limited number of possible fates, which are rather less than the number of occupations one might follow in our industrial society. The course which it follows is, like that of a human being, the course which is determined by social relationships."[87]

"Theories of development and regeneration", according to Holmes, "must start with the totipotency of nuclei, the absence of qualitative division, and also with the fact that when sufficiently undeveloped the cytoplasm also is totipotent. In other words, the egg is, as Hertwig contended, essentially isotropic. Each part of it can produce any part of the organism."[88] According to Holmes the regulation of growth can be accounted for by the symbiotic or cooperative relation of the cells in the cell division. The cells multiply in a certain direction to fulfill a need. There is the relation of demand and supply. The relation is similar to that which we find in the self-regulating social organism. "The manifold diversity of industries, for instance, does not represent a system consciously planned and carried out. It results from the efforts of each individual to follow the

pursuits from which he derives the greater reward. In an organized industrial society the different employments followed are determined largely in accordance with the principle of supply and demand. People are not sewer diggers and garbage collectors from choice. In general, men get their living as they can and not as they will. . . . A society is an organism which regenerates its missing parts, regulates the proportionate development of its different parts, and undergoes an orderly differentiation of its various organic systems. Its development may be described as epigenetic. The fate of a part is a function of its position or, in other words, what a man becomes is largely due to the environing circumstances under which he is placed. . . . Its early embryonic stages may be perfectly isotropic. Like all organisms it would be shaped to a certain degree by environmental influences. But like all organisms the fundamental nature and modes of response of its component units would mainly determine the course of its evolution."[89]

Can we apply the analogy of the social organism to the lower organic plane? There are organisms which live together symbiotically, i.e., to mutual advantage. In the convoluta, certain algae live in the tissues of the animal cells and these organisms have become dependent upon the algae. "The algae derive food in the form of carbon dioxide and other waste products of their host, and eliminate oxygen which is utilized by the host." We might cite higher organisms where "good bacteria" play an important part in the life of the host. But the question here is the relation of cells in the growth of complex organisms. Holmes pictures the cells in such an organism as standing in a symbiotic relation. Some cells in the later stages are differentiated but some are undifferentiated, and can be drawn upon for a variety of uses in the building and restoration of the organism. Holmes does not define what he means by an undifferentiated cell, further than by its plasticity for building material. Cells in the later division obviously are not undifferentiated in the sense in which he assumes that the original cell is undifferentiated, i.e., they cannot produce a complete individual. The form of such an undifferentiated cell "is determined by the kind of

activity which it is called upon to perform." It responds according to need. This may be illustrated in the restoration of missing or mutilated parts, in immunity reactions, etc. We know how the white corpulscles in the blood multiply when a healing process is involved. "In the specialization of embryonic cells the impressed functional changes involve considerable differentiation of structure, while in the reaction to antigens the modifications of the cell do not proceed so far. Both kinds of changes may be regarded as physiological adjustments, the one to normal neighbors, the other to foreign invaders."[90]

There can be no doubt that the interaction—physical and chemical—of cells in the genetic process is an important aspect. But it does not explain everything, as Holmes frankly admits. The group-pattern at any one stage is the condition of the division of labor. But it is also the result of the division of labor. To say that the regulation in the case of growth and repair is the result of need is somewhat anthropomorphic when applied to the organism. Are the collective cells conscious of a need to grow in a certain direction? We must remember, if we take the analogy of the social organism, that needs also emerge in the process of evolution. We must not hypostasize needs as independent agents. The sort of need which is implied in growth and repair implies, however vaguely, a schema or plan. Society is not such an automatic affair as Holmes seems to imagine. Social forms are the result of inventive planning, however pragmatic, in the first instance. An industry does not just happen spontaneously. In social development at any one time there is the schema of the past of which at least the dominant participants are conscious, whether the subordinate participants are conscious or not. The dominance is not just the collective result of the individuals, but involves conscious planning somewhere. While the schema in biological growth and repair is not psychologically conscious, yet here too there must be some sort of schema.

We cannot get rid of some predetermination in the way of structure, though it must be dynamic structure having reference at every step to the environment and to the interaction of

parts in the process. The mechanists have not been wrong in emphasizing structure, but their conception of structure has been too atomistic. There is living, forward-looking structure in the development of the organism, though it is not, as in society, a foresight based upon imaginative ideas. Furthermore, it is not true that society is an equipotential system where a man's function is determined merely by his position in society. Human individuals are not just the last wave of the vital impulse, undifferentiated because lacking definite structure, as are the cells of the ectoderm. In a stereotyped caste system it has indeed seemed as though a man's function were definitely determined by his position. If born in the laboring class he seemed destined by nature to be a laborer and even a certain kind of laborer. But even in such a system there was a dominant class of individuals who used the others as material. And under freer conditions of competition, we can see that an individual is not determined merely by his position. He is a functionally complete individual and may by his enterprise rise to a dominant position. In the organism, the cell seems to be drafted on account of its position. Human beings may refuse to be thus drafted. But it is true that the organism is not just a heap of blocks, physically and chemically juxtaposed. There is a power of realizing a whole, of adjustment, of forward-looking enterprise. How shall we account for this?

We have seen that the problem of organic development has been attacked from various angles and with varying emphasis. Sometimes the investigator has taken a retrospective view and emphasized predetermination, the control exercised by the past. If he no longer pictures a miniature organism in the original cell, yet he postulates a complete set of determiners at the outset, legislating the whole course of development, at any rate so far as "normal". Sometimes the investigator has been prospective and has emphasized the emergent character of the organism—either as a result of the influence of the environment; or as a result of the mutual interaction and control by the constituent cells; or as a result of the cooperation of both these agencies, with varying emphasis on each. No doubt all these

lines of attack have contributed to the understanding of the problem. "The life cycle of the individual is the result of a delicate equilibrium, involving not merely the structure of the germ-plasm—including the cytoplasm as well as the nucleus—but also its dynamic relation to the interacting system of cells and the relation of the whole process, from the beginning to the end, to the external system of energies."[91] None of the above lines of attack gives us the whole story.

I do not believe that we can understand the individual as a collection of factors, even with an accidental environment added. This is true even on the lowest levels of life, but it becomes increasingly apparent when we deal with the life history of the more complex multicellular organisms and try to understand their behavior. Physics has been obliged to abandon the idea that the physical world is a mere collection of atomic entities and to think in terms of fields with their nuances and harmonics. If this is true on the primary level of nature, it must be even more apparent when we deal with living things and their lace work of interrelations. But we must think of organic fields in their own terms. They are not resolvable into physical electromagnetic fields, though the physicist to-day is trying to assimilate his entities to the living and even to the psychical type. Organic structures have their own laws of maintenance which are not merely those of inorganic structures, as J. S. Haldane has so convincingly shown.[92] Since the field is a dynamic field, it varies in the process of adjustment. *It has reference to time.* This reference the mechanistic conception ignores. There must be somehow a temporal whole-form or whole-field, giving individual uniqueness to the organism and operative throughout the developmental process. To regard the organism as a whole-form from the very beginning of its existence and throughout its history, it is not necessary to assume a transcendental factor—spaceless and timeless like Driesch's entelechy—merely inserted into the process. The whole-form must be immanent in the process, as Aristotle emphasized. It must be intrinsic and dynamic. Without such a field the developmental process and its functioning in its environment become unintelligible. Because of this whole-

form the process becomes a whole-making process, as is evidenced in growth and in the reparation of tissue. It must be operative through the interaction of cells and in relation to the environment. It must carry with it the past and look forward to the future.

But how can we conceive the operation of such a whole-pattern? To conceive it as merely operating mechanically, as Weismann did, so it is present as a collection of determiners in the original germ-plasm and then separated out in the cell division, until at last there remains just a particular determiner for each cell, prescribing its destiny, is contrary to evidence. We have seen that even the cells of the ectoderm are not thus determined for a specific function. Moreover, a collection of determiners is not a whole, and we must still show how they can function as a whole-pattern. The whole-pattern cannot be a mere collection nor can it be divided in the subdivision. When one considers how the germ-plasm is shot to pieces by X-rays—as in one of Goodspeed's experiments on tobacco plants, where the germ-plasm lacked two chromosomes and had only fragments of four others and yet developed (so long as the functional connection of the parts remained) into a complete plant and produced some seeds that developed into complete and productive plants—it seems that the germ-plasm must function as a whole and not merely as a collection of factors. Now that we know that all living tissue radiates and even know its wave-length, it is easier to see how the organism can be such a total field and how the whole-pattern can be immanent in the parts. It is this whole-field which regulates the emergence of chromosomes, their "reduction" in maturation, the division of cells in the building of the organism, the restitution of parts and functions, when there is injury, whether at the earlier or later stages, even in injury to the brain.

I can see only one possible way in which the organism can function as a whole. There must emerge in the synthesis of the individual, within the cosmic environment, a new entity, a formative pattern, a soul, to use Aristotle's and Harvey's language. This is not external to the elements any more than the

design is external to a house, but it is the organism as a whole-making process. It is immanent in the parts, though not in their particularity. It is what makes them parts of a whole, rather than a collection of factors. The organism is more than a collection of factors. It is a whole. It remembers, it intuits, it looks forward according to its own genius. The multicellular organism is more than interacting cells. It organizes these into an energetic unity with a pattern of its own. There is, if you like, a psychological element or aspect to the process; but this principle is immanent in the process as a whole, and it is by virtue of it that the collection of factors is a whole. You may retort: Why not say that a crystal or even a molecule or an atom possesses soul? They act as wholes and have unique characteristics. I have no objection to extending the meaning of soul to this extent. There is the emergence of a new whole-forming pattern in all these cases. But we must recognize different levels of soul. The soul which emerges in organic genesis is not personality with imagination and thought. That is a later emergence in the social milieu. The organic soul has its own characteristics —its own sense of wholeness, its own memory and foresight, its own methods of adapting means to ends. It emerges as a result of the synthesis of two streams of heredity in the milieu of its environment—somatic and cosmic. It controls the interaction of parts and follows a logic and a sense of fitness of its own.

Let us now try to sum up the point of view we have tried to outline. If we consider embryological development, we must postulate a dynamic forward-looking structure or whole-field which Aristotle called soul. This is not something external to the physical and chemical constitution—a transcendental abstraction as with Driesch—but the unique organization or control within which the chemical factors figure. This whole-form is an energy system of vast complexity, but it is not an aggregate of mechanical factors; this whole-form persists throughout the process of cell-division, where there is cell-division. It realizes itself in the symbiotic differentiation and cooperation of cells and organs in the embryological process; the whole-process includes the environment—somatic and external. There is no

reason to suppose that the chromosomes have any absolute prerogative in this development. They are themselves part of the functional differentiation in obedience to the genius of the whole. It is admitted that all the cells have the same chromosome structure. Their differentiation is analogous to that which we find in a bee hive, where the specialization into queen bees and workers is obviously a result of the functional process in response to the needs of the hive. There is no *a priori* reason, therefore, why the germ cells should be absolutely indifferent to the changes in the somatic milieu. While experimental evidence may not at present be conclusive, paleontological evidence points in that direction. Only so can we explain the evolution of the sense organs, for example.

The critical problem is the problem of adaptation. Natural selection cannot account for adaptive structures, for natural selection is not a constructive principle. It can only act by elimination. The creative principle must work somehow within the stream of life. If, however, we conceive the mutations of the germ plasm as occurring in isolation from the environment, it is impossible to understand how there could be the progressive adaptation which is manifest in the evolution of life. Nothing short of a pre-established harmony between life and environment would seem to answer. To this Morgan is finally driven. He thinks the mechanical conception can carry us part of the way. "The mutational changes would not be chaotic events in the ordinary sense, but specific events that are at each step determined by the chemical constitution of the hereditary materials in the germ-cells."[98] Such mutations could arise only rarely. It is only because they are rare that "they appear to us to be due to chance. But by laying all emphasis on the importance of the materials in which the change takes place, we get a picture of necessity rather than of chance. This, I take it, is the view that the mechanist would adopt as his working hypothesis. Further than this he would probably not like to go unless he were philosophically inclined—in which case he would probably call attention to the extraordinary coincidence that such mutations, being limited, have yet sufficed to bring about

the innumerable varieties of evolutionary changes. He would, no doubt, claim that there must be some sort of ultimate, pre-established relation between a specific internal molecular order and the order of the external world.''[94] Such a pre-established harmony would have to include all the various types of adaptation in nature—adaptation to the life environment as well as to the inorganic. And what about the maladaptations? If the problem of evil is difficult to understand (as Morgan insists) in a universe directed dynamically, it would be still more so in this artificially harmonized universe. It is far simpler to approach the problem of adaptation from the point of view of creative interaction.[95] In this trial and error process, we can understand the failures as well as the successes of adaptation.

While the mechanistic hypothesis has done great service in bringing order into the facts of life—as the mechanistic hypothesis in physics has done great service—yet one cannot but feel that (like the old atomic hypothesis in physics) it is a superficial account of the facts. If the genes, as Morgan supposes, have been present since the stage of the amoeba, with but slight modification, we can be sure that they do not explain the evolutionary process. Life cannot, moreover, be understood as a collection of parts. In phylogeny and in ontogeny alike evolution is from the whole to the part—a differentiation of structure within a general control. This is forward looking. The gestalt of life must have reference to the future, but that does not mean that the future is bodily present in the beginning. There is a whole control—call it field or soul—which is to be realized in interaction of parts within a definite environment. There are not specific determiners for the specific end-results, present in the germ-plasm at the outset, as Weismann supposed. Life starts by being largely equipotential. It takes on specific determinations through division and interaction of parts in its proper milieu. However we may have to conceive the whole-control, it is present throughout the whole process. It is a control or gestalt in time as well as in space and includes the division, interaction of parts and environmental conditions. Aristotle had, I think, the right intuition, however inadequate

his statement must necessarily be. In generation, a new whole-form is created (or emerges if you prefer) and this has reference to the future.

Fresh light on this subject is coming from the embryological studies of the neurologists. The neurologists, in investigating the embryological development of the nervous system, have found themselves obliged to discard the mechanical model of a bundle of substances which are supposed to determine the cycle of development. We must, according to Coghill, view embryological development "not as a static pattern in space, but as a dynamic pattern in time. . . . The neuro-embryologic study of behavior shows that events within a behavioral system can be understood scientifically only as their relation is known to subsequent as well as to antecedent phases of the cycle. The antecedent tells a part of the story about the present, but not all of it; for within the present are events that have behavioral significance only in that which follows. . . . The purely scientific method, dealing exclusively as it does with space-time relations, can not reject the future from its explanation of the present in behavior, because any event in an organismic cyclic system is an integral part of both the future and the past. Whatever time may be in the absolute, as a function in behavior it works backward as well as forward."[96] Coghill's analysis is based primarily upon Amblystoma, but he gives corroborative evidence from the investigations of vertebrates. In the light of the evidence, he lays down "three neuro-embryological principles": (1) "the primacy of a mechanism of total integration", i.e., a controlling whole-pattern having reference to time as well as to space; (2) "the development of local mechanism by acceleration of growth within a relatively equipotential system" under the control of the spatio-temporal pattern; (3) "progressive organization from the whole to the part." "The organization of a localized functional centre of the nervous system progresses from the whole to the part. Symmetry of the whole is not acquired by the accretion of individually symmetrical parts; but the symmetry of parts is acquired by compensatory growth under the leadership of the whole."[97] It is impossible here to go into the

details of Coghill's evidence in the embryological development of Amblystoma or to follow the application of the principles to the higher vertebrates or to show their relevance to the evolution of psychological behavior. Coghill is concerned with individual evolution but believes that the same principles hold for racial evolution. Herrick's extensive comparative research into the evolution of cerebral patterns of localization illustrates the same principles in phylogeny: "The evolutionary history of the lateral geniculate body shows how a highly specific pattern of localization has gradually emerged from a diffuse and non-specific arrangement."[98] It is evident that the new physics is going to liberate biology from its bondage to the mechanical model of the old physics. Biology like the new physics is going to take time seriously.

To understand the evolution of life, we must not isolate it from geological evolution. Life is part of the crust of the earth. It pulsates with the pulsation of the earth. We must, moreover, view the whole of geological life as a cycle, having reference to time as well as to space, just as we must understand the individual organism—cell or multicellular organism—as a cycle. The cycle of geological life is part of the earth cycle. Life is sensitive to the premonitory changes in the earth's crust —since it is part of the crust—long before the changes become castastrophic to the spectator; and it moves, so far as its inertia permits, to meet the changing conditions by a genius of its own. This anticipation of the future H. F. Osborn calls rectigradation or aristogenesis. "Aristogenesis is a creative process from the germ plasm of entirely new germinal biomechanisms; the process is continuous, gradual, direct, definite in the direction of future adaptation." Aristogenesis requires long periods of geologic time and is illustrated, according to Osborn, in titanotheres, horses, proboscidians.[99] Goldschmidt insists as against Osborn, that such anticipatory adjustment can be accounted for by mutations, taking place mechanically and cumulating in the germ plasm in advance of the geological changes. These mutations take place independently of the environment but enable the mutated organisms to live in the changed environment.[100]

Neither Osborn's nor Goldschmidt's explanation seems probable unless we suppose that life as part of the crust of the earth is sensitive to the preparatory changes and responds with synthetic adaptation to meet the conditions. The rising of the earth's crust, for example, would produce tensions and tremors, would liberate radioactivity in advance of the large-scale changes and these disturbances would extend to life as part of the crust, though the germ plasm may have sufficient inertia to withstand the changes, as is illustrated in the stability of the reptiles while the mammals underwent profound change. But change is not sufficient; there must be a direction of change—a gestalt of life history having reference to time, as the earth's history is a gestalt having reference to time. Dynamically and prospectively there must be a gestalt of geological life history as a whole, including dynamic wholes such as phyla and species. I do not mean that this whole of life, with its hierarchical subwholes, is present in the beginning and merely unfolds in the course of geological history. On the contrary the whole-pattern with its subpatterns is created in the history of the earth. But the whole-pattern is prospective in the sense that it includes the conditions. The life-cycle is part of the earth-cycle which in turn is part of a cosmic cycle; and the cosmic cycle is itself a whole-gestalt in time. The life drama is not a mere series of episodes but a whole in which the first scene foreshadows the succeeding scenes as part of a creative whole. But the succeeding scenes are not part of the first scene. All are orderly parts of a whole-plot which has reference to time.

We must look upon phylogenetic evolution, as well as ontogenetic evolution, as a whole-process having reference to time, in which life presses on to maintain itself in its environment and responds, through its own genius, to the action of the environment, by new characters and organs, as it is able. There are, no doubt, accidental variations due to the contingency and multiplicity of factors within the germ-plasm. But such variations could not account for adaptation. The adaptive variations must be looked upon as the constructive effort on the part of life to maintain itself in its environment. We must not conceive life

as isolated from the cosmos of which it is a part. In life, on the contrary, we see the whole cosmic urge for expression. The taking on of life patterns—the differentiation of life into plant and animal and of these into phyla and species—is not due to life in isolation but to life as a cosmic urge realizing itself in the milieu of nature. We cannot say with Bergson that the whole evolution of life with its branching and radiation is already present in the original life impulse, if we mean by that the earliest form of life. Rather, the structures of life emerge in the particular histories under local conditions, but they emerge within the cosmic whole which presses toward expression in the parts of the cosmos within their specific milieux. These milieux themselves emerge under cosmic control. Else there could be no fitness between life and its environment. The forms of life are as truly determined by the architecture of the field of the whole as are the forms of atoms, molecules and crystals. And they are dynamically determined, i.e., they have reference to time as well as to space. They must be understood with reference to the whole history of development of which we can know only a part. But we must also recognize that the realization of the forms of life is not a mere function of the whole but involves also the initiative and inertia of the responding individual with its history. In this individual reaction we have the element of indeterminism and the root of maladjustment and evil as well as of advance in nature.

We are obliged to regard evolution as the expression of cosmic genius in the milieu of nature, rather than as a heaping up of accidents. The mechanical theory of nature and life fastened its attention on elements and regarded organization as accidental to the mechanical grouping of elements. But the new conception of the universe emphasizes organization as fundamental. The elements themselves have become relative and plastic, and owe their character to their functioning in organizations. This is true even in inorganic evolution. But to our limited insight the forms here seem automatic. It is in the evolution of life where we can watch the progressive invention of patterns. This is beautifully illustrated in Gregory's "Basic Patents in Evolu-

tion.''[101] He compares the paleontologist's findings in nature to the engineer's examination of the evolution of the patents which gave rise to the present airship. In the patent office, the expert can see how step by step the present airship arose from the basic patents of a long history of invention. The paleontologist in like manner, though with vastly greater difficulty, can now trace the basic patents in the locomotor evolution of vertebrates from the basic patent of the striated muscle in the early fishes to the cumulated complexity of patterns involved in man's upright posture, with the changes of form and organs required to accomplish such locomotion. The present structure of man contains not only a clear record of his present habits but also an obscure record of his past habits, which led up to the present structure. ''In short, the detailed evidence of comparative anatomy leaves no substantial doubt that upright-walking man has derived all four of his limbs from the corresponding organs of some early four-footed animals, that these quadrupeds derived their limbs from the paired paddles of certain air-breathing, lobe-finned fishes, and that they in turn derived their paddles from the simple fin-folds of still earlier shark-like fishes. Such were the 'basic patents' of our motor system.''*

In considering both the impressive series of human patents and the still more marvelous series of patents in nature, the observer must remember that there were many tentative starts and futile efforts (which may not appear in the record), since the viable patterns in either case were the result of a trial and error process of discovery. But the cumulative continuity of significant constructive effort which he does find should none the less convince him that here he has to do with intelligence and not merely random trial and error. Considering the enormous complexity of the factors involved, it is incredible that merely random changes could have accomplished the result, whether in the human patent office or in the patent office of nature. The striking thing in either case is the continuity of

* ''Basic Patents in Evolution,'' William K. Gregory, *Scientific American*, August, 1930, p. 113. One should examine Gregory's diagrams to be convinced.

effective inventiveness. If there is genius in nature and if the genius of man is itself an expression of the genius of nature, then evolution becomes, in a measure at least, intelligible. T. H. Morgan objects to the paleontologist's findings that they are the result of macroscopic observations, i.e., observation of nature at the level of our sense perception, and not microscopic, i.e., based upon the finer structure of nature. To this we might retort that the promiscuous mutations in Morgan's experiments are also macroscopic observations. The macroscopic world is the world of our direct observation. The microscopic world (such as atoms and electrons) is beyond our observation. It is an invention to account for the characteristics and order which we find in our macroscopic world and has validity only in so far as it explains our macroscopic observations. This the mechanical hypothesis fails to do, while Gregory's hypothesis appeals to our intelligence.

The geneticist's experiments are at best artificial, while the paleontologist observes nature's own experimentations under conditions set by itself. If it has proved impossible to synthesize artificially even the simplest organic compounds, such as glucose, so that they respond to light as the organic compounds *in vito* do (because we have not succeeded in reproducing the conditions in nature, which at some time in the earth's history gave rise to life), how much more difficult to reproduce the ensemble of conditions in nature at the level of organic species such as fruit-flies. We must remember that in the laboratory of nature there are present a vast number of factors which we may not be able to reproduce in the artificial laboratory. There is also a logic in the evolution of life in nature. Species do not just arise at random nor do characters and organs. But the evolution of life is the realization of an urge in response to the conditions of nature. The pulse of life varies with the whole geological pulse. Lull has shown the importance of the rising of the earth's crust, in the changes of species. The rising of the earth's crust means more than a change of climate in the way of temperature and aridity. It means also the liberation of radioactive energy, pent up within the crust. Such changes must quicken the pulse of

life. But such acceleration could not account for the progressive structure of life. This must be understood from the point of view of the cosmic urge of life and its genius in inventing suitable patents.

We must also recognize a certain internal rhythm of growth and maturity in life itself, so that some species become fixed in their characters while others, less definitely adapted, remain plastic, as shown by the stability of the reptiles while the mammals underwent profound change. Man still remains plastic with marvelous powers of inventiveness to form new patterns of relationships to respond to the structure of his environment—not only material and organic, but spiritual as well. The insects, we know, have remained unaltered in structure for vast geologic ages, as evidenced in the amber beds of the Baltic. Perhaps the reason why the artificial mutations of flowering plants have shown promising variations is that the latter are less stereotyped in nature.

Both the mechanist and the vitalist have over-simplified the problem of life. Both have failed, in their artificial experiments, to take account of the factor of time in the synthesis of nature. Nature operates over long periods which cannot be reproduced in the laboratory. By artificial stimuli, such as X-rays, we may accelerate the pulse of nature, but we do not thereby account for the synthetic activity of nature. The mechanist fails to see that the factors of heredity cannot be a mere aggregate. They must be under a control, and this control must include history, past and future, as well as present. It must include the environment, not merely the immediate environment but the whole cosmic environment in which the individual's racial and geological history runs its course. It is a control which guides and yet in the individual history is in the making, for the individual form changes. The vitalist in turn over-simplifies the problem in supposing that this control is a mere external addition to the life process. The relation of the control to history and to the environment must be considered. The control must be dynamically immanent in the whole-process; and it must reflect, albeit in terms of its individual genius, the adjustment of individual

history to the genius of the whole. We must take account of the whole urge for life and more abundant life, not only from the point of view of the particular life history but from the point of view of the cosmic drive. Just as in the emergence of physical structure we must take account of the harmonics of the whole cosmic field, as well as the immediate conditions, in order to understand the nature of the electron and the atom, so we must take account of cosmic structure to understand the emergent patterns of life and mind. But there is also an element of pluralism and contingency in nature, because all creative adaptation must come through individual centres of energy; and these centres have an initiative and inertia of their own. They are not just functions of the whole. Hence the blindness, waste and conflict in the universe.

To understand the characteristic of wholeness in the emergent evolution which we observe, we must view it in relation to cosmic structure. The harmonics of individual structure must evolve in response to the harmonics of the cosmos and can exist only in unison with this cosmic structure. We must conceive the cosmos as dominated by a whole-structure, as being itself in some sense a gestalt, and not merely a collection of parts. This whole-structure must be conceived as dynamic, as whole-forming, as soul. If matter repeats itself in similar patterns throughout the universe by virtue of the genius of the whole, so must life repeat itself, for the same reason. It is incredible that matter should emerge by virtue of a cosmic structural field and that life, which is only a more complex organization of cosmic energy, should happen by chance. Life, like inorganic matter, is conceived in the womb of the cosmos. The structure, stability and development of any individual must be conceived in cosmic terms. There is the interaction of parts with its contingency, but there is also a whole-making activity, cosmic genius, operating through the parts, so far as they lend themselves to such whole-making in the particular conditions and at a particular stage of history. For experimental purposes we may ignore the cosmic situation and fasten our attention on the immediate factors, for the cosmic situation is a constant. It is real, nevertheless.

The ultimate determiner is the environment, but not an environment of mere weather. What about the adaptation to a future environment, not yet emerged in the particular history, such as the history of our earth? An accidental environment of mere weather can no more account for the structural history of life and intelligence than can the accidental combination of elements within the germ-plasm. Even if we admit the storing up of experience as subconscious memory or habit from generation to generation, this does not help us to account for the structure of the past, still less to account for the emergence of new levels of structure. The course of life and intelligence, as well as the course of matter, must be accounted for in terms of the structure of the cosmic field. As in the simplest vibrations of matter, the whole cosmic field is involved, so in the highly complicated reactions of life and mind. The whole history of the earth runs its course within the guiding field of the cosmos, as truly as the earth as a body in space runs its course along the geodesic line of cosmic structure. This structure has to do with time as well as space. It is a dynamic guidance, looking forward to the future as well as backward to the past.

Chapter 6

EMERGENCE AND STRUCTURE IN SCIENCE

Emergence in the Psychological Sciences

In surveying the biological sciences, as in the survey of the physical, we have found an increased emphasis on emergence in nature. But again it is not mechanical emergence merely that we must recognize, but emergence guided by structure. In the development of modern thought the other sciences have trailed physics, especially mechanics which was the first science to establish itself. But though physics has been revolutionized in the twentieth century, the later sciences are only slowly feeling the revolution and still work largely with the models of the seventeenth century. Biology is just trying to liberate itself from the mechanical model; and the psychological sciences are trailing behind the biological. We shall now examine emergence in the psychological sciences.

Is there a psychological level distinct from the biological level? This depends in part upon definition. In a broad sense, human life, with all its progress, may be included under biological evolution. But it is not customary to include the whole gamut of living behavior under biology. If we did, the problem would be to discover new levels within biological evolution. The distinction between the biological and the psychological sciences is due chiefly to the need of division of labor in the sciences. It is well for the psychologist to realize, as Aristotle did, that he is engaged in the study of living behavior in its wholeness. Where the line is to be drawn between the psychologist's and the biologist's study of behavior is a matter of convenience. We may say that psychology begins where there is an indication of learning from experience. How low down in the scale of life the psychologist must go is a matter of evidence. Jennings and others have shown that unicellular organisms act differently after being exposed to stimulation. How such action is to be interpreted is another matter. Higher in the scale we find that organisms are

able to revive patterns of previous experience in the absence of stimulation. Should such revival, whether dreaming, or revery or waking memory, with a conscious reference to the past, be included in biological behavior? That obviously lies with the biologist. It is only when we come to constructive imagination and abstract thought that there seems to be a clear break in biological evolution. Here, at any rate, the organism does no longer depend merely on association by habit. There is a different attitude to the material of experience—that of insight into relations. With the development of language and social dialectic, the individual becomes able to reconstruct actively his routine experience by conscious analysis and synthesis for an end in view. At this juncture Plato and Aristotle felt that a new principle comes into behavior—creative reason. This principle was for them mind, *nous*, in the strict sense. The three levels then would be inorganic matter, life (as routine) and reason.

Hume voiced the ambition of psychology in his day when he expressed the hope that the laws of association—contiguity, similarity and causation—might play the same rôle in unifying psychological phenomena that gravitation had played in unifying physical phenomena. Hume took over the atomistic conception of physics. He conceived psychological phenomena as a succession of particular events—perceptions, ideas, feelings—following each other with incredible rapidity. The problem was how to predict such events, and Hume thought this could be done by means of laws of association. His method was that of introspection, and this has, until recently, been the method used by modern psychology. Hume's conception of the absolute discreteness and independence of psychological elements was later modified somewhat to conform to the facts. J. S. Mill noted that the psychic events become modified in synthesis, and he gave the name mental chemistry to this fact. George Henry Lewes and Herbert Spencer, contemporaries of Mill, invented the term emergence for such novelty—a term lately resurrected by C. Lloyd Morgan. But the atomic conception was retained. Spencer thought of the ultimate atoms of psychology as nerve-shocks which by their density produce the elementary feelings; or,

rather, the primary feelings emerge from such density. The integration of the primary feelings gives rise to a secondary level of feelings and this to a tertiary, etc.,—each level exercising a certain dominance over those below it.

If later psychologists abandoned the language of physics and chemistry and accepted the more complex psychological unities as facts for analysis, they still postulated the existence of such primary elements as sensations and feelings. These were supposed to be the atoms out of which our psychological structures are built by means of the external laws of association. At the same time they subordinated psychology more and more to physiology. They looked to neural processes for the causal explanation of the psychological sequences. Huxley invented the term epiphenomenon to indicate that the psychological events are concomitant with physiological changes without affecting their course. But most psychologists preferred the more equivocal term, parallelism, which was easily turned into an idealistic metaphysics. Dualists, like William James, who held to the independent status of mental events, still sought to explain the sequences of mental events in terms of physiology. Needless to say, the physiological models were conceived atomistically and mechanically, though such teleological categories as interest were sometimes allowed a certain status, side by side with mechanical habit. But to be really scientific meant to reduce interest also to neural mechanism.

The mechanistic neurological model, having been invented in the service of an atomic theory of mental facts, seemed to serve the purpose. The physiological model, which was generally accepted, was topographical. The human organism was conceived, for psychological purposes, as consisting of sense organs and a nervous system. The nervous system was pictured as made up of neurones with their fibres. These neurones were supposed to be anatomically distinct, though this fact has only recently been established. The elements of the sense organs were supposed to be projected upon certain sensory areas of the cortex by means of afferent fibres, with point for point correspondence, though the detailed relation was vague and conjectural. The

motor areas of the cortex, on the other hand, where the motor fibres were supposed to originate and to be projected to the various organs, were definitely mapped according to supposed experimental evidence. The motor areas and the sensory areas were conceived as interconnected by the neurones of the intervening regions, which were called association areas. In some way the separate neurones were supposed to shoot into each other dynamically and to form junctures, called synapses. It was supposed that the interconnections of mental phenomena could be explained in terms of such interneuronic connections. Whether the connection between the anatomically independent neurones was to be conceived electrically or chemically was not clear. But it was assumed that the course of events, neurological and psychological, could be explained by the facilitation of irradiation which the synapses canalized.

For a long time only the cerebro-spinal system was considered, but in order to account for the feelings and emotions, it was found necessary to take account also of the autonomous nervous system, involving the vital organic processes, such as breathing, circulation of the blood, digestion, sex. Recently it has also been found necessary to take account of chemical agencies, such as the secretions of the ductless glands, in order to understand the variation in tone and energy of the nervous system. But the emphasis has been upon the synapses, connecting the individual neurones through their axones and dendrites. The topographical picture has dominated physiology and therefore psychology, both as regards the areas of the sense organs and of the corresponding areas of the cortex. Such phenomena as colour contrast should have indicated a dynamic overlapping of areas, but until recently the topographical conception has remained unshaken. Psychological processes have been conceived as built up of elementary units into constellations; and these constellations have been explained by constellations of synaptic junctions among neurones.

Until recently psychology has proceeded on the basis of introspection, checked by experimental technique; and the neurological language has been in fact merely symbolism for the psychological interpretation. But the whole procedure has been

dominated by certain atomistic presuppositions which go back to Hume. If psychologists have been impressed at times with the importance of the concrete interrelations, these have evaporated in the mechanical physiological explanation. Psychologists have found what they looked for. But since 1912 there have been evidences of revolt from the tradition of psychology. This has been manifest in Behaviorism and in Gestalt Psychology. Behaviorism has maintained that introspective evidence is uncertain and irrelevant. What counts is physiological behavior. The founder of behaviorism, John Watson, had specialized in animal psychology, where the introspection of the subject of investigation can play no part. We merely observe reactions. The ambition of behaviorism is to exclude psychological language altogether and to use only the language of physiology. That the observer must have reference to his introspective experience in order to interpret behavior has not occurred to the behaviorist.

At the outset, the behaviorist makes the assumption that there are certain native responses or reflexes of varying complexity. The more complex may be called "instincts", but the behaviorist prefers to call them complex reflexes. The original reflexes can be ascertained from the responses of a baby soon after birth. They are such as grasping, sucking, fear and anger. Why the period soon after birth should be given this privileged character is not clear. Presumably, it is because the baby has not yet learned to adjust itself to its external environment. But the baby has a history of several months and has been adjusting itself to its pre-natal environment. If the behaviorist had taken the embryo's responses at various periods of its pre-natal history, he would have found different reflexes at various stages of its development. The behaviorist's selection, therefore, is purely arbitrary. The embryologist takes as his unit the whole life cycle from conception to maturity and death. One stage for him is no more important than another for showing what is innate and what is acquired. Every stage of development has its own emergent characteristics. For the embryologist the absolute reflexes, postulated by the behaviorist, simply do not exist. And they do not exist for the scientific neurologist.

Having made his arbitrary selection, the behaviorist accounts

for the changes in adaptation by "conditioning", which means that stimuli associated (neurologically of course) with the reflex may become cues for calling off the reflex. In Pavlov's experiment, if a dog has heard the sound of a bell when given his piece of meat, the mere sound of the bell when heard again makes his mouth water. The dog may learn to combine reflexes by finding that he cannot get the piece of steak by launching at it but must assume a certain posture first. Reflex, however, suggests a simple stereotyped response, such as the knee-reflex or the eye-winking reflex has been supposed to be. Whether such responses can be regarded as reflexes in the behavioristic sense or not, they do not seem to furnish the basis for education. To call the drive for food a reflex seems to be an abuse of language. To reduce thought to incipient movements of the vocal chords does not seem to make us any wiser about the process of thinking.

But what concerns us here is that, while the behaviorist has substituted physiological language for psychological language, his conception of human behavior is as atomistic and artificial as that of the psychologists whom he criticizes. His neurology remains the same. His pictures of cadavers give no insight into the functioning of a living human being. He is quite right that to understand human behavior we must take the human organism as a whole. But what is the wholeness of the living, functioning human organism? Is it just a bundle of reflexes? Is a human organism merely a physiological automaton? It is certainly the irony of history that when the physicist finds it necessary to introduce psychological categories in order to interpret the behavior of nature even at its primary level, that of electrons and photons, the psychologist should try to exclude psychological categories in the interpretation of human behavior—in order to be scientific. It would be well for the psychologist to unlearn the mechanics of the nineteenth century and go to school to the physics of the twentieth century.

Far apart as introspective and behavioristic psychology seem to be, they are in fundamental respects equivalent. While introspective psychology is based upon psychic elements and be-

haviorism upon reflexes, one is as atomistic as the other. And so far as the connectedness of the elements is concerned, "conditioning" is as vague as "association". In neurological terms there is no difference between them. Both assume hereditary paths or established synaptic junctions between individual neurones as the basis for behavior; and both assume that, by some sort of irradiation, new paths or synaptic junctions between neurones may be established. If it is an association between a light stimulus and a sound stimulus, as in Pavlov's experiment, there must be intermediating neurones between the topographically separate areas. Both types of psychology assume a constant relation between peripheral stimulation and the neurones of the cerebrum. Otherwise the conception of synaptic junctions would be useless in explaining reactions. But it is impossible to reconcile such constancy of relationship with the facts. To quote Lashley: "If we train the animal to jump to a white erect triangle and to avoid an inverted one and then confront him for the first time with the outlines of these figures in smaller size, he will choose the correct outline without error."[102] But in that case, as Lashley points out, different peripheral areas and different central neurones would be involved. We should have "a habit learned by one set of cells and executed by another." The relation between peripheral stimulation and central reaction cannot be so simple as the topographical conception supposes.

The behavioristic concepts of reflex and conditioning are too simple to account for the facts. "I believe," says Dodge, "that the doctrine of direct bonds between a specific stimulus and a specific reaction, instead of being the general plan of all behavior, is either an artifact due to imperfect description or a specific limiting case of laboratory experiment. In every-day human life, as well as in the laboratory, most specific reactions are selected phases of a complex of organic response evoked by a complex flux of stimulation and inhibition, some part of which is arbitrarily called the stimulus. This dual flux reaches into a more or less remote past and a more or less remote future. It shows a highly complicated system of present meanings in

individual experience and appears as extensive ramifications or spread and systematization of impulses within neural tissue. In this flux the recurrence of identical set-stimulus-reaction sequences is highly improbable. The usual sequences are between more or less variable systems. They may be called for convenience the stimulus system and the reaction system, but in reality the relation is quite intimate."[103] In actual behavior there are no isolated acts. This is true of the simplest as well as the most complex acts. "Each beginning anticipates an end, each end is also a beginning. Some of these ends are quite unconscious, some are conscious only as premonitions, while some are fully conscious or are represented by surrogates. The knee-jerk is really complex, however simple it appears. Operating on a basis of psychophysiological set from previous stimuli it may begin with a quick lumbar reflex in a generally useful direction which develops, by the interaction of higher neural systems, toward such complicated adjustive acts as maintaining equilibrium or eliminating obstacles according to the direction of the central elaboration of the sensory data. There is no evidence that the adjustive act is a conscious end of the jerk which begins and in a measure anticipates it."[104] In speech we have an illustration of conscious anticipatory action. "The real stimuli to the next word are not given alone in the previous word or sentence but in premonitions of the future, the ending of the current sentence, its place in the argument of the paragraph and the total discourse. Every word is at once a fulfilment of the past and an anticipation of the future." We must consider the stimulus in connection with the total system of dominant tendency. "The eye movements in re-reading the same text are never twice alike. The meaning may be essentially the same."[105] The atomistic physiology of behaviorism is as inadequate as the atomistic psychology of introspection to account for the drive and meaning of psychological behavior.

The epoch-making experimental work by Shepherd Ivory Franz and K. S. Lashley has shown conclusively that the old topographical conception of the cortex is untenable. The work of Franz shows that while habits may be disturbed by the le-

sion of certain areas, as in various aphasias, the result is due not merely to the destruction of a specific area, "but to a disturbance of a more complex mechanism"; and in his experiments in re-education Franz has shown that the habits may again become effective. "In both human and monkey experiments the results show that after the destruction of an important part of the brain the lost functions may be recovered. Moreover, they show that the functional return may take place to such a degree that there is a possibility of finely co-ordinated movement as well as those of a gross character. They also indicate that some other part or parts of the nervous system may assume the functional attributes of the lost parts."[106] In these pathological investigations, according to Franz, "the results point to the conception of brain function as an integration, as an activity of many parts of the brain working together."

Similar results are indicated in a recent series* of experiments by Franz and his assistants on the transfer of the effects of training in normal human beings. It is shown in the first study that, after learning with one eye, the training has been transferred to the other eye so that it makes equally effective reactions. This result may be interpreted to indicate, in neurological language, that the same Calcarine area in the cortex was involved in each case. It appears to be a specific effect. But it is difficult to see how the elements in one retina could have the same neuronic connections in the cerebrum as those of the other retina. The third study indicates that training gained by a certain horizontal retinal area is transferred to an eccentric retinal area. "The extension is noticeable over a retinal (and cerebral) area equivalent to as much as twenty degrees." (There appears to be a variation between the extreme limits of some-

* "Studies in Cerebral Function," Series in Education, Philosophy and Psychology, University of California at Los Angeles, University of California Press, 1933. These include (1) "Peripheral Retinal Learning and Practice Transfer," (2) "Cerebral Dominance as Shown by Segmental Visual Learning," (3) "Transfer of Effects of Learning to Other Retinal Areas," (4) "Simultaneous Reading with Both Cerebral Hemispheres," (8) "Training in Touch Perception and Cross-Education," (9) "Diffusion Effects Following Localized Tactile Training." For the technique of the experiments it is necessary to consult the studies with their tables and diagrams. Vol. I, nos. 3-11.

thing like twenty per cent.) Since different cerebral areas are involved, this result indicates a general cerebral effect of training. The eighth and ninth studies show that there is cross education in skin areas and their cerebral counterparts, similar to that in retinal areas. The experiments upon the left forearm and the right thigh indicate a transfer of training to the corresponding contra-lateral areas in each case—analogous to the cross-education of the retinae though not so pronounced. But they also indicate a diffusion effect or a transfer of training to homolateral and eccentric areas, involving presumably different segments of the cortical area. "The improvement is sufficient to warrant the conclusion that special training of one area of the skin-cerebral mechanism may bring about a corresponding general improvement for many other parts of the body." If we translate "the results into terms of cerebral function, they show that a training of a small area of the skin may have an effect over a larger area of the cerebrum than that relatively small part of the post-central cortex which is supposed to be connected with the special training area." The fourth study shows strikingly the integral action of the two hemispheres of the cortex. "Experiments were made which demonstrated the possibility of reading words, when one half was 'seen' by the right half of a retina and its corresponding cerebral hemisphere, and the other half by the left retinal-cerebral mechanism." It must be remembered that the right half of each retina is supposed to be projected upon the Calcarine area (in the occipital lobe) of the right hemisphere while the left half is projected upon the corresponding area in the left hemisphere. Any considerable movement of the eye in the above experiment is precluded by the short stimulation (one-tenth of a second) and by the necessity of taking account at the same time of a third object just above the focal point. Yet even so there can be no absolute correspondence in the stimulation at different moments of perception and at different sittings. In our ordinary seeing, as Franz points out, corresponding and non-corresponding parts of the retinae are stimulated at the same time and in varying degrees according to the angle of perspective, and yet the result is integrated in

the cerebrum. When we perceive with two or more senses at the same time the process is all the more complicated though not the result. It seems hopeless to figure out such integration on the old theory of localization.

K. S. Lashley's experiments on learning and re-learning by rats, on which he performed various lesions of areas in the cortex of the cerebrum, as well as lesions of the association paths and projection paths, "point to a functional organization independent of differentiated structure and to some more general energy relations within the central nervous system."[107] His results run counter to the assumptions of current psychological theories "that reactions are determined by local conditions in limited groups of neurones, that learning consists of the modification of resistance in isolated synapses, that retention is the persistence of such modified conditions."[108] Behavior cannot be thus rigidly departmentalized. The individual neurone and the particular synapses of individual neurones cannot be made the basis of distribution for the integrations involved in behavior. "If, as seems probable from the study of the refractory period of a nerve, the response of the neurone is momentary and is followed by a quick return to the resting state after every excitation, there can be no general fund of nervous energy capable of cumulation and diversion into various activities."[109] The discovery of the all-or-nothing law as regards the action of nerves seems to preclude the conception of the individual neurone as the basis of energy distribution and makes it necessary to look for "some more general dynamic organization," having reference to difference in frequencies, carried by the nerves.

The synapse does not seem to be a necessary condition for either learning or retention. The learning process, in the way of modifiability of behavior, has "been found in organisms with syncytical type of nervous system, so that it is not clear that the synapse is either essential or important for learning."[110] And the experiments upon the retention of habits, formed after injury, indicate that "the retention is conditioned by the total amount of functional tissue and not, primarily, by the inherent properties of the synapses themselves."[111] In short, "there is

no evidence to support this belief in identity of nervous elements. On the contrary, it is very doubtful if the same neurones or synapses are involved even in two similar reactions to the same stimulus. Our data seem to prove that the structural elements are relatively unimportant for integration and that the common elements must be some sort of dynamic patterns, determined by the relations or ratios of parts of the system and not by the specific neurones activated."[112] We are reminded, however, that this lack of specificity of conduction "does not mean that the functions of the cortex are not integrative, are not highly differentiated for each specific activity, but does imply that the functional differentiation must be largely independent of both the macroscopic and microscopic structural differentiation."[113]

For the understanding of Lashley's experiments it is necessary to survey his carefully tabulated data. These show the results, from varying extents of cerebral destruction, upon a variety of functions, in varying complexity of maze reactions. The data include the retention of maze habits formed before cerebral destruction, and also the effects upon learning and retention of habits after varying extents of cerebral destruction. Some of the results, as summarized by Lashley, are: "The capacity to form maze habits is reduced by destruction of cerebral tissue. The reduction is roughly proportional to the amount of destruction. The same retardation in learning is produced by equal amounts of destruction in any of the cyto-architectural fields. Hence the capacity to learn the maze is dependent upon the amount of functional cortical tissue and not upon its anatomical specialization. Additional evidence is presented to show that the interruption of association or projection paths produces little disturbance of behavior, so long as cortical areas supplied by them remain in some functional connection with the rest of the nervous system. The more complex the problem to be learned, the greater the retardation produced by any given extent of lesion."[114] In general the results seem to indicate that the integration in the cortex "is not a summation of diverse functions, but a non-specialized dynamic function of the tissue as

a whole" and that "the mechanisms of integration are to be sought in the dynamic relations among the parts of the nervous system rather than in details of structural differentiation."[115]

Being a scientist of real insight, Lashley has been able to give due credit for intelligence to the rat. The learning process of the rat is not that of an automaton, bumping up mechanically against various obstacles until by a mechanical process of fixation, it has established effective habits. On the contrary, the process would be impossible except for discriminative perception and retention which at their best approach insight as we find it in higher animals. Hence he is able to generalize the results for the rat so as to throw light on cerebral functioning in human intelligence. He suggests that "data on dementia in man are suggestive of conditions similar to those found after cerebral injury in the rat." One cannot help being impressed with the correspondence of the results of Franz, in human aphasias and human re-education, with the effects, upon habit and retention, of the artificial destruction of cerebral tissue in the rat. There can be no doubt that such work as that of Franz and Lashley opens up a new interpretation of the functioning of the organism, though the suggestion that integration of behavior depends upon "the quantity of cerebral tissue" is tantalizingly vague.

Other eminent neurologists such as Adrian and Herrick are coming to the support of Franz and Lashley to demonstrate the failure of anatomical models of the nervous system. This does not mean a general denial of the specific localization which the clinical neurologist has over-emphasized. "Undoubtedly there are," says Adrian, "well-defined nervous pathways, clear differences in cell structures and localized activity in different parts of the brain. As a modern addition to the evidence we have Foerster's recent work on electrical stimulation of the human cortex, and his finding that stimulation of the temporal lobe may cause sounds and words to arise in consciousness, whilst stimulation of the occipital lobe gives lights or images. Bard has given another remarkable illustration of strict cortical localization by his observations on certain postural reactions in

the cat. These depend on a limited area in the frontal region, are not affected by damage to other parts of the brain, but are permanently lost if the frontal area is destroyed. The danger nowadays is that we may pay too little attention to such facts; but it is true, nevertheless, that the localization is a matter of areas rather than of single neurones. This is shown by examination of habit formation, and by the remarkable way in which the nervous system adapts itself to injury."[116]

In the field of habit formation and re-learning, Adrian agrees with Franz and Lashley that the old theory of a specific relation between stimulation of the sense organs and specific neurones in the cortex must be abandoned. "It has often been pointed out that we learn to recognize shapes—the letters of the alphabet, for example—however they are presented to us. The pattern of black and white made on our retina by the letter A need not fall on a particular set of retinal endings connected with particular neurones. We have learnt to recognize a relation of lines and angles, a pattern of activity in the cortex rather than an activity of specific points. This kind of relation is not due to our superior intelligence. Lashley finds it in the rat, and psychologists of the Gestalt school have pointed out examples from all manner of animals. There is the same neglect of specific neurones in the formation of motor habits, for if we once learned to write the letter A with our right hand, we can make a fair attempt to write it with any group of muscles which can control a pencil. The adaptations to injury present a different aspect of the same story. An insect which has lost a leg will at once change its style of walking.... When the central nervous system is injured, there is more evidence of localization of function, but the localization is no hard-and-fast affair. A rat uses its occipital cortex in the formation of certain visual habits. When this part of the cortex is destroyed the habit is lost, but it can be relearned just as rapidly as before with what remains of the brain."[117] Such a recovery of function does not mean the development of a new visual region. No part of the cortex is any longer essential.

The question arises, how can the grey matter act as a whole?

"How do individual neurones combine to produce a system which can recognize a triangle or direct the movements of the organism with such disregard of detail?" There is so far no answer along physiological lines. Adrian suggests that "the electric oscillations in the cortex and in the grey matter generally are often due to a large number of units pulsating in unison" and "that when these collective rhythms appear the neurones are already acting as a unit."[118] These rhythms may form a bridge in all directions independently of the dendrites. "The patterns of activity in a system of this kind would be like the ripples on the surface of a pond, with the difference that some of the ripples may occur spontaneously, whilst others are due to incoming signals. Interference figures and modes of vibration may then be all-important." But Adrian admits that "this does not take us very far." No doubt nature has long ago accomplished television in the sense of sight. All seeing of forms is in fact television for it is mediated by separate vibrations to the brain, and unified by some kind of wave-mechanics in the brain. But while sensuous forms, such as triangles, may thus in the future find a physiological explanation, we cannot thus account for the *recognition* of triangles or for mathematical limits.

The researches of Herrick support those of Franz and Lashley so far as the processes of learning and re-learning are concerned. But Herrick warns us "that no single formula of cerebral localization can be written. Each type of performance has its own anatomical pattern which must be discovered, by patient research. For some types of function there are no local organs with stable or rigid arrangements of neurones, for these organismic or totalizing activities are general in their reach and fluid in character. Yet the tissues which perform them are not structurally homogeneous or physiologically equipotential. In these integrating functions the amount of tissue activated is a factor in the situation as Lashley has shown, but diversification of structure and of pattern activation is essential, for this is the apparatus of our mental life in both its analytic (sensory) and its synthetic (rational) aspects."[119] Herrick sums up his researches so far as they bear upon the human cortex under three

types: "The human cerebral cortex, then, exhibits three types of localization of function. The first is in the projection areas, which can be mapped in mosaic patterns on the surface. These are determined primarily by their respective subcortical connections. Probably all parts of the cortex have some subcortical connections, but the principal systems of projection fibres are related with specific and clearly defined cortical areas. The second type is an expression of the architecture of the intracortical association systems. These stable arrangements of cell bodies and related association fibres constitute the apparatus of our standardized patterns of behavior and mental activity. This apparatus is present throughout the cortex. The functions performed by it are more or less permanently localized, but the pattern of this localization is very intricate and it cannot be projected upon the surface of the brain in mosaic designs like those of the projection centers. Third, in addition to the localized systems of projection and associational neurones, there is in the cortex an enormous mass of non-specific tissue. This is everywhere abundant; it varies in structure from place to place and in function from moment to moment. It integrates all cortical activities, synthesizes experiences and provides the plasticity of structure requisite for learning and higher mental processes in general."[120] Herrick offers no explanation of the dynamics of this whole-functioning of the cortex and it is doubtful whether any such explanation can be given in purely physiological terms. We have mentioned above Adrian's suggestion.

In the meantime there has been evident an increasing revolt within the psychological tradition against the particularism of the fundamental concepts of the older psychology. It should be remembered that psychologists, like other scientists, help themselves to concepts that will meet the facts, irrespective of tradition. Teleological concepts like interest, attitude, meaning, purpose have been used along with the mechanical concept of habit. Even so orthodox an atomistic psychologist as Titchener was obliged to invoke the category of "set" as well as the category of habit to account for directed recall. (Incidentally it sounds anomalous that this atomistic psychology should have been called

"structural psychology".) Some facts have always resisted reduction to the simple category of habit. It has not ever been possible to reduce recall by means of similars to habit, yet similarity plays a large part in the integration of mental processes; and without it the more complex processes, such as analogy and inference, would be impossible.

Even on the plane of direct sensory experience, such a phenomenon as colour contrast cannot be explained by the strictly topographical conception of particular stimulation of nerves and neurones. It implies dynamic interaction within the field, whether peripheral or central or both. Psychologists were obliged to recognize that complex processes such as a musical clang are experienced as having a unitary character, even if, like Ehrenfels, they regarded the unity as a form quality, superimposed upon the elements. So far back as the last decades of the nineteenth century, William James and Stumpf (under whom the gestalt psychologists received their training) had emphasized the deliverances of direct experience as against extreme elementarism. The clang is a unitary fact, even though by analysis we may discover complexity within it. The taste of lemonade, according to James, is not a taste of sour and sweet but a unique fact. James showed further that the transitive relations are as much part of the warp of experience as are the resting places, which we abstract as qualities.

The revolt against elementarism in psychology was consolidated by the so-called Gestalt Psychology, which was founded by Max Wertheimer and of which W. Köhler and K. Koffka are well-known interpreters. The term gestalt, as used by these psychologists, is difficult to define because of its large range of meanings. In philosophical German usage, as for example in Hegel, it means pattern or form. It is an equivalent for a Platonic Idea. In the earlier history of the gestalt movement, gestalt is associated with insight and here comes nearest its traditional meaning. Insight has to do with the conscious discovery of the relation of part to whole in the carrying out of some desired end. In his study of the *Mentality of Apes*, Köhler found that some chimpanzees do not merely show evidence of regulating

their conduct by habit of the trial and error kind, but are able to discern relations of means to ends within the situation. Thus if bananas were beyond their reach, they would use a stick and if they could not reach them that way they would pile up boxes, left conveniently around. This insight was not the result of mere endless fumbling, but of a taking in of the situation in a rather abrupt sort of way, after preliminary bafflement. But gestalt has come to have a much broader meaning than that suggested by insight, which belongs to a high level of psychological behavior. Gestalt covers all psychological phenomena, but its emphasis is on wholeness. Gestalt psychology rejects the notion of real elements, such as sensations and feelings, from which the older psychology tried to compound experience. The concrete phenomena of our direct experience are the real facts. The wholes that we experience are not a sum of elements. They have their own character as wholes, just as we experience them.

The gestalt movement had its conscious start in Wertheimer's stroboscopic experiment.[121] Wertheimer found that "if at some distance from each other, two stimuli are successively projected upon the retina of a subject, a movement will be seen, starting from the locus of the first and ending in the region of the second. Under favorable conditions there will not even be 'two impressions'. One 'thing' will move from one place to the other."[122] It is the experience we have in looking at the moving pictures of the cinema. Wertheimer found in this and similar experiments a refutation of the summative theory of sensory experience. How could this consciousness of movement be the result of a succession of isolated impressions? Wertheimer came to the conclusion that a new conception of cerebral dynamics was called for, that more was required than the stimulation of isolated cells in the brain, that there must somehow be a short-circuiting from one area of the cortex to another.

In general we may say that gestalt psychology holds that a dynamic whole-action of the brain is an essential condition of the experience of wholeness, of which the stroboscopic movement is an instance. Gestalt psychology charges that both introspective and behavioristic psychology have dealt with the or-

ganism's relation to the environment as a piecemeal affair and have neglected the integrative rôle which the organism as a whole plays in our experience and our reactions. Stimulus-response is too simple a way of characterizing behavior. We must have a triadic relation, viz. stimulus-organization-response. "Instead of reacting to local stimuli by local and mutually independent events (in the sense organ and in the cortex), the organism reacts to an actual *constellation* of stimuli by a total process which, as a functional whole, is its response to the whole situation. . . . To a given local stimulus there may correspond altogether different experiences as soon as surrounding stimulation is changed."[128]

At first the emphasis on the reality of wholeness in our direct experience and the denial of real elements gave rise to the objection that, in such a case, there could be no analysis and therefore no science of psychology. To this, gestalt psychology replies that we can distinguish parts or factors in the concrete situations and that the variations of parts in intensity, extent, etc., change the experienced situation, but such analysis does not destroy the experience of wholeness. The clang remains unitary even though we distinguish parts. Furthermore the parts owe their significance to the whole in which they figure. The situation is analogous to a chemical compound, rather than to a mechanical aggregate. The situation must be regarded as a dynamic situation of interacting forces, not as an addition of fictitious elements, such as sensations.

The parts and properties which we discriminate are relative parts and relative properties, which owe their experienced character to the total situation. The perception of constancy of brightness, of shape and of velocity is a perception of relative brightness, relative shape and relative velocity within the field of direct experience, not that of an absolute relation of peripheral stimulation of certain nerves to a specific set of cells in the cortex. This can be shown by experiments with chickens as well as with human beings; and in the former case interpretation in the way of prejudice can be largely ruled out. As another illustration of the importance of relative properties we may cite

the transposition of stimuli. Suppose that the animal first learns to react to a darker square of two squares and that we afterwards change the situation, by using the darker of the two squares and with it a square correspondingly darker than this, instead of the lighter one. The animal will react, not to the dark square to which it reacted before, but to the darker of the two squares.

That animals respond to relative rather than absolute properties has been strikingly shown in Heinrich Klüver's experiments on monkeys. "The general problem set was to pull in one of two (or more) boxes, which were differentiated from one another by some physical characteristic, as for example weight. The monkey was first trained to pull in, say, the heavier of two boxes of given weights: when training was complete the weights of the boxes were altered throughout a wide range, and it was found that the monkey almost invariably chose the heavier of the pair quite irrespective of the absolute weights. Then the appearance of the boxes was altered in various ways, but the response to the bare relation 'heavier than' was still maintained. This type of experiment, using the pulling-in technique, was extended to many other characteristics, such as shapes and colours, and most interesting results obtained."[124] In summing up Klüver's results, K. S. Lashley tells us in his Introduction: "Not only are the animals sensitive to the same physical stimuli (as man) but for them also the relational properties of the situations are the same. As with man, reactions are but little dependent upon the simple physical properties of the stimulus but rather upon abstract relations which may subsist in physically unlike situations." What guides animals and ourselves in our reactions are the relative properties of the field, not the absolute stimulation of the nerve endings of the retina; and, therefore, we can react with constancy to shapes, sizes, brightnesses and weights which, so far as the absolute stimulation is concerned, vary all the while.

Gestalt psychology has shown, moreover, that our processes of association and recall depend much more upon dynamic belonging together in wholes than on temporal and spatial con-

tiguity, which the old psychology stressed. Contrast the drive to complete a sentence or the search for a forgotten name with the noise that breaks in upon you. The latter may be ignored as irrelevant. Direct experience is shot through with dynamic relations. Not only spatial and temporal relations, but relations of causality are part of the concrete situation. The chimpanzee, who was trying to reach a banana outside the cage with a stick which had a branch on it, and who was blocked by the branch hitting against the bar, angrily bit at the branch. It recognized the causal relation in the situation. To single out this relation from its complex setting and to act upon it as such requires insight. Not only relations but configurations are part of direct experience. Difference in brightness is a very effective means for marking things off, while colours tend to fuse. The world of direct experience is not a mass of mere particulars which must be artificially organized into meaning by a transcendental mind, or compounded by neural habits, but is relational and patterned experience and is perceived, remembered and understood as such, though that cannot mean that all relations and all patterns are open to immediate inspection. We should not require science if that were so.

We may say that gestalt psychology has been an emphasis on the reality of the concrete deliverances of experience as over against analytical abstractions. Further it has looked upon these situations as dynamic situations to be understood in terms of energy and the interactions of energies, not as inert subjective entities existing in a world by themselves. It is not necessary to quarrel about the originality of the ideas advanced by the gestalt psychologists. The important thing is that they have made the issue sharp. They have limited themselves mostly to gestalt in perceptual situations, but the same approach can be carried into the organization of sentiment, imagination and thought; and indeed in these fields a great deal of relevant work has been done without the use of the term gestalt. The gestalt point of view, however, is rapidly unifying our problems of psychology. Its very vagueness enables it to be all things to all psychologists.

But useful though the movement has been in emphasizing a new approach to psychology, its explanatory categories are hopelessly vague. Like behaviorism, gestalt psychology has laid the stress on the physiological explanation of behavior, and in turn it has reduced the physiological to physics and chemistry. Köhler views the organism as "an astounding system of electromagnetic entities." The dynamic distribution which is to account for the gestalt character of experience is electrodynamic distribution, conceived according to classical physics. Köhler accepts the topographical distribution of conduction along special nerve fibres and neurones for the nervous system below the cortex. The dynamic distribution for him begins with the striata of the occipital lobes. Physiologists now are inclined to extend dynamic distribution to the sub-cortical centres. Moreover, there must be dynamic distribution in the peripheral areas, as well as in the cortex. While we know little of nerve-conduction, it seems that the number of nerve fibres and neurones involved rather than individual fibres and neurones, must be taken as the basis of conduction. As Lillie says, "We have definite physiological evidence (e.g. in vision) that a stimulation or activation involving only a few elements may fail to reach the level of affecting consciousness, while if a few more elements are activated (i.e., if the 'threshold' is overpassed) a definite sensation involving physiological response follows."[125] At any rate the perception of visual pattern must be related to dynamic distribution in the peripheral field, as well as in the cortex. The striata of the occipital lobes, according to Lashley's evidence, seem to occupy no more fundamental position in the dynamic distribution than the rest of the cortex.

But we are concerned here with the general concept of dynamic distribution. Köhler compares topographical distribution to water distributed in pipes, while dynamic distribution is compared to the distribution of a drop of water in the sea, where there are regular laws of orderly distribution as truly as in conduits. But the distribution of water in a vessel seems to Köhler preferable to distribution in the sea. The vessel presumably would correspond to the skull and the enclosing membranes

of the brain. According to Köhler the distribution of atoms in a molecule is an example of such free distribution, there being nothing to limit the distribution in space. Schrödinger has pointed out that Köhler's gestalt is adventitious, depending upon external conditions, while chemical distribution, as of the electrons in an atom or the atoms in a molecule, is due to an immanent gestalt or structure of the field, which determines the distribution and gives rise to the distinctive properties of the whole. It is not true that space, in the sense of the field, is indifferent to the distribution. The uncontrolled distribution of electromagnetic entities could not give rise to the sort of gestalt which is implied in chemical processes and still less could it account for the distribution in the psychological field with which Köhler is concerned.

The fact is that while Köhler has a great deal to say about the reactions of the organism as a whole, the organism, as he conceives it, is not in a true sense a gestalt. An organism is not just a system of electromagnetic entities—the product of free distribution according to the laws of physics. It is a specific type of gestalt with its own laws of maintenance and distribution—laws which are not statable in terms of inorganic physics and chemistry. This conception of the organism was clearly set forth by Claude Bernard. It has recently been experimentally established by J. S. Haldane in his classic work on breathing and by J. L. Henderson in connection with the circulation of the blood. What is characteristic of the organism is a certain type of whole-control, which cannot be explained by the type of distribution with which the inorganic sciences deal; nor can it be stated in terms of the chemistry of the cells in their particularity, for the activity of the cells in the multicellular organism is subject to the dominant control by the whole. You may call the distribution physical and chemical, but what is important is that there is a specific type of control which cannot be understood in terms of inorganic physics and chemistry.

When in turn we deal with the psychological organism we are confronted with types of behavior which cannot be explained in terms of biochemistry. We have here characteristic types of

guidance which can be understood only in psychological terms. Processes of psychological association are not intelligible in merely neurological terms. They have a drive and a sequence, a belonging together, which cannot be understood in terms of merely spatio-temporal contiguities, as Köhler has well pointed out. When we deal with the level of insight, in the special sense, viz. the abstracting of the relations which are significant for the realizing of a special end, the neurological language of habit becomes still more patently insufficient. Here we have a radical departure from the routine of nature. Here it seemed to Plato and Aristotle that we need to assume a cosmic addition to the biological process. And on the analogy of the physical sciences, we would seem to be justified in assuming a new gestalt, where we are dealing with a new type of behavior.

I have used the expression psychological organism, instead of the customary expression psychophysical organism, which Köhler uses. The latter implies a dualism of the psychical and the physical; and Köhler, following the Spinozistic tradition of parallelism, postulates two series of processes which have a point for point correspondence with one another. "My general hypothesis states that the concrete order of actual experience is a true representation of the dynamic order of corresponding physiological processes. Therefore, if to me my language is an adequate 'symbol' for my own direct experience, it is an objective 'symbol' for those physiological processes at the same time."[126] This parallelism according to Köhler holds not merely for the experience of spatial and temporal relations, but for all types of intimate experience of belonging together. "If the subject says, 'This book is bigger than that,' his words may be interpreted as stating a definite direct 'comparison-experience' which he is having of the corresponding dynamic relationship in his physiological process."[127] The behaviorist uses the physiological language exclusively. Köhler can use either the physiological language or the language of direct experience, for the two for him are equivalent. But a comparison presupposes an observer, who belongs to the psychological series. What becomes of the observer in the physiological series? If there are two

kinds of gestalt, how can they correspond? If there is only one gestalt, functioning in a specific way, why have two kinds of language? If psychological functioning is a different level of functioning from physiological there can be no parallelism. We cannot establish a point for point correspondence between the behavior of the molecule and the separate behavior of the atoms which compose the molecule. They are different patterns with different properties. It is plain that Köhler has not grasped the real significance of the gestalt of the organism.

A psychological organism functions in certain characteristic ways that are not the ways of an organism which is not psychological. The psychological level is an emergent which in the nature of the case cannot be put into one to one correspondence with a simpler level which does not possess some of its characteristics. This fact precludes explaining psychological by what we call physiological processes. Every level, as Engels emphasized, must be expressed in categories of its own. While, moreover, we speak generically of the gestalt of a psychological organism, we must remember that there are various levels or grades of psychological organism. What seems clear from the evidence is that a psychological organism has its own typical field of control. This field of control is to a considerable extent independent of the macroscopic and microscopic anatomical structure of the brain, as shown by the evidence of Franz and Lashley. We must get rid of the dualism of Descartes and Spinoza and go back rather to Aristotle's conception of the soul as a whole-form or whole-control. In a general way, we may say that the soul is the integration or whole-functioning of the organism at a certain level, viz. the level of significant behavior. To be sure, we should have to translate Aristotle's whole-form into terms of dynamic control and distribution. But it is a distribution which evidences a certain type of gestalt—a gestalt which is not statable in terms of reflex action or mere habit, much less in terms of inorganic distribution.

If we use the language of the new physics, we may say that everything—electron, atom, molecule, organism—has a particle character and a field character. This has now been proved experi-

mentally for atoms as well as for electrons; and we may assume that it holds for more complex individuals. The particle character symbolizes individuality, contingency, uncertainty of prediction. The field character symbolizes structure or gestalt. It indicates the levels of possible choices. It establishes the control which makes the atom function differently from the electron, the molecule differently from the atom, the organism differently from the isolated cells. The old macroscopic physics was concerned with the gross aspects of nature which are directly revealed in our sense experience. The new microscopic physics is concerned with the minute structures of nature which we can know only indirectly. The ultimate exchanges of nature are inter-atomic exchanges of quanta of energy—electrons and photons. These exchanges are conditioned not only by the structure of the interacting parts but also by the structure of the whole. The action in nature is not haphazard action but directive action. This is true on the elementary levels of nature with which the inorganic sciences deal, but it becomes more obvious when we deal with the organic and psychological levels of nature.

Can we refer this directive action solely to inter-atomic influence, as Lillie does?[128] It does not seem that the directive action in the interactions of atoms within an organism can be accounted for solely by individual atoms. Some of the atoms must themselves be directed. There must be "key atoms" which transmit the directive influence by means of electricity or other means to the rest of the mass of atoms and molecules. "Transmitted influences of this general kind would be selective or directive in their final incidence if the initiating atomic action were directive."[129] But we must still explain the directive initiating action. It is true that "in the transmission of physical influences, units of action (quanta) are transferred from atom to atom"; and that "the vital directive activity would consist in controlling the time and direction of this transfer."[130] But what makes the initiating atomic action directive? We do not get rid of this problem by merely changing the scale from macroscopic to microscopic. Leibniz tried to describe nature in terms

of individual atoms, the monads. But he had recourse to a divine pre-established harmony to account for the directive action in nature. We cannot use Leibniz' language, but if there is to be directive action in the matrix of nature, it must be because of the structure of the field in which the atoms interact. There is a certain indeterminacy on the part of the interacting entities, but the total result of many interacting entities indicates direction, because of the structure or gestalt of the whole. There must be in the case of the organism a gestalt of the organism as a whole; and this is not definable in terms of the mere interaction of the constituents—atoms, molecules or even individual cells. To account for the directive influence not merely within the inter-atomic processes of the organism but also for the directive relation of these processes to the environment, there must be a gestalt which includes both the organism and the environment. To understand behavior in nature, including the organism, we must take into account not merely the parts but also the whole-form in which they function. Everything acts as an individual but the individual action is determined by the gestalt or structure which is characteristic of the whole.

If we apply this duality of particle and structure to the psychological organism, we may be able to reconcile Plato's conception of the soul, which emphasizes the particle character—individual freedom and choice—with Aristotle's conception which emphasizes the structure character of the soul, its whole-control. If we stress the analogy to physics, we may say that the soul as structure is determinate at any one moment. It indicates the levels of possible choice. But the particle character of the soul, its individual initiative, is indeterminate. We cannot locate the soul as Descartes did, who envisaged only the particle character of the soul. We can only say that the soul is where it figures in transactions and that it must be in one of the levels indicated by the structure of the psychological field. Its position between encounters is uncertain. It is the structure which gives character to behavior, but there is also the novel and contingent fact of choice which makes development or degradation possible

in conduct, according to the level which is chosen. The alternatives of choice are determinate, but the act of choice which actualizes one of the possible alternatives is indeterminate. The more thoroughly conduct is organized, the more surely is choice likely to fall on permissible and viable alternatives. In any case, conduct is determinate after the choice, so far as the past is concerned. In ordinary customary conduct, the alternatives are stereotyped and the conduct is largely predictable. The dynamic field has become grooved through habit. When we deal with large numbers, conduct becomes practically determinate statistically. But, in any case, an individual act is an emergent fact and not a mere repetition. And while the result may be in general accordance with customary expectation, we cannot predict absolutely the particular result, even at the level of the reflex. Conduct is not so stereotyped in fact, as we ordinarily, in our gross observations, suppose it to be. Experimental psychology has shown that animals are not such automata as Descartes dogmatically assumed. We know that on the level of insight, at any rate, there is the possibility of creative advance, though the errors in discovering the most viable forms of conduct are many.

While we speak of gestalt as the whole-functioning of an individual, we must not forget that the individual exists only in adjustment to a specific environment. The human individual is part of a community and the community is part of the individual. The Middle Ages emphasized the community aspect of the individual. According to the mediaeval view the individual is saved through the Christian community. The individual is capable of no effective initiative of his own and has no value apart from the community. The Renaissance emphasized the other aspect of the individual, the particle aspect—initiative and adventure. For Hobbes the community is nothing but a collection of individuals, held together by an artificial bond of self-interest; and the modern conception of society has been dominated largely by this atomistic point of view. It has emphasized the initiative of the individual and regarded society as accidental. Like physical atomism, of which it is the social counterpart, it

has neglected the field in which the individual functions. A social group is no more a mere collection of individuals than a molecule is a mere collection of atoms. The group has a gestalt of its own; and individuals have characteristic properties which are due to their being members of a specific community, just as atoms come to have new properties because they are integrated into a specific molecule, though human individuals have far greater degrees of freedom than material atoms. The one-sided emphasis of the Renaissance on the particularity of individuals in society was a necessary complement to the one-sided emphasis by the Middle Ages on the community aspect. But in the tragic confusion to which individualism has led in our complex and closely interwoven life, it is necessary to come back to the community aspect, without forgetting the particularity aspect of individual freedom and initiative.

We must relearn the lesson, emphasized anew by recent science, as well as by social suffering, that nothing lives to itself. Everything is a member of a community. The electron is what it is because of its relation to the cosmic environment. In the atom the electron is part of the cosmic community, but it is also part of a more specific community. The more complex the individual, the more specific is the community, but all communities are part of the cosmic community and live within its field of control. An organism cannot be understood apart from its environment. Its breathing is as much a function of its external environment as of its internal environment. The gestalt of the organism includes the environment of the organism, not only in a specific sense but also in a cosmic sense, for the dynamic distribution of energies in which it lives is part of a cosmic distribution and subject to cosmic laws of which we know but little. A psychological organism is not just a physiological body of a certain complexity and gestalt; it can develop only in a community of psychological organisms. Mind is a group function. It is through social interaction that we develop minds. The biological stream of individual heredity flows into the milieu of social history and takes on its habits and patterns. It is by interacting with other psychological organisms of various levels

of maturity and by making our own the historical tradition of culture, that we come to have the characteristics which we have. The individual gestalt is interlaced in dynamic interaction with the historic social gestalt and comes to its own unique expression in this gestalt, which it in turn may modify for better or worse. There can be no real psychology, therefore, which is not social psychology, i.e., which fails to take account of the individual's being rooted in his anthropological environment.

Up to the present, psychology has dealt with individual characteristics and behavior as though the individual were an abstract entity who could be investigated by himself, without reference to his specific environment.[181] In this it has followed the old physics. The new physics has taught us that physical entities have no characteristics and indeed have no existence except in specific fields. We come to know physical entities only in group interactions. The same is true of psychological individuals. The fields in which psychological individuals exist are far more complex than physical fields. They include indeed the physical fields for we are part of the physical nexus of nature. But a psychological field includes also the complex milieu of the organism with its structure and its adaptation to its environment, and this includes life as well as the physical environment. Animal life is possible only by its symbiotic relation to other life, plant and animal. Plant life alone can live directly off the physical environment. We are animal organisms and require an environment of life as well as a physical environment. But we are also psychological organisms and as such require not only a physical and biological environment but also a psychological environment. We can develop and be understood only in terms of the matrix of our psychological group relations.

To understand human behavior we must learn its history. The immediate situation does not suffice. In a broad sense, it is of course true that everything has a history and must be understood through its history. But in the realm of matter the timespan is enormous and so far we have only conjecture concerning the history of matter, though on general grounds we are convinced that the atoms and possibly the electrons have evolved

from a simpler matrix of nature. Since Darwin, biology has studied life with reference to its history with a new comprehension of existent forms of life. But while we may be convinced that the present forms of life must be understood through their history, we must infer this history from the record in the rocks. In human behavior we can take account of history in the making. But we cannot understand human history in isolation from the world of which human life is a part. As physical beings we share the history of physical nature, and the understanding of a human organism requires physics and chemistry, even though these are not sufficient by themselves to explain human behavior. As biological beings we are part of the history of life upon our earth. Through a vast span of time the stream of life has prepared the organization, which, through the differentiation of parts within the economy of a whole, has enabled the organism to respond to its environment with specific structures and organs. Through its distance receptors of eye and ear it has become able to respond to stimuli remote in space as well as by chemical contact. On the psychological level of evolution, life has added, to the distance receptors in space, distance receptors in time by means of structures through which it can respond to stimuli remote in time. By the duration of habit and memory, the individual can respond to present situations on the basis of reactions to past situations, and through the activity of free imagination it can prepare for the future on the basis of the past. In the higher stages of animal development individual experience is eked out by tradition or social heredity so that the individual can get the advantage of the cumulative experience of its kind. Biological heredity cumulates somehow through mutations in the germ plasm and requires long periods of time. Social heredity is communicated through the intercourse of individuals within the group and is primarily carried in the memory of individuals, but in human history memory is eked out by records, whether in writing or artifacts, which give a larger access to the past and a more efficient control of the present.

We have seen that to understand behavior we must take account not merely of the individual but of the group within which

the individual figures. We must distinguish three types of groups with their characteristic laws of interdependence and distribution of energy. We have physical groups, biological groups and psychological groups. An example of a physical group would be an atom, which is a group of positive and negative electrons, or a molecule which is a group of atoms. The pattern of an atom or molecule conditions its exchanges of energy with other atoms or complexes of atoms. A unicellular organism or even a bacterion may be regarded as a biological group of factors which has its own laws of synthesis and maintenance, but a more obvious example would be a multicellular organism which in turn has its characteristic whole-pattern which realizes itself through the symbiotic organization of its constituting cells and through its exchanges of energy with the sustaining environment. The laws of maintenance of a biological group cannot be reduced to the laws of maintenance of physical groups. With the emergence of the biological organism new laws controlling distribution of energy also emerge. The biological group has reference to time in a way which is not paralleled in the physical group. Life is self-perpetuating and, to a certain degree, self-restoring in a sense in which the physical group is not. It must have required a long period of time for life to evolve a symbiotic group of cells which could act as a self-maintaining unit within its environment. Such a complexity made possible a far greater specialization of parts and a far greater responsiveness to the environment than could be attained on the level of unicellular life. Again, an example of a psychological group would be a society of interplaying individuals with various degrees of co-ordination or sub-ordination to realize a common life. The relation between parts is no longer physical and chemical, as in the biological group, but psychological, being conditioned by signs of various sorts. In developed human relations verbal signs play a dominating rôle. A psychological group can no more be reduced to a biological group than a biological group can be reduced to a physical group.

The psychological group must be recognized as a new level in the advance of nature, as the atomic group and the multicellu-

lar group are new levels. It is futile to try to explain the psychological group by analogies from the biological organism. Herbert Spencer and others have drawn parallels *ad nauseam* between the psychological group and the biological organism. Such parallels are for the most part fictions. The psychological group has its own laws of maintenance and of distribution of energy. It has its own type of heredity. Its field includes not merely the physical and biological fields but it has dimensions of its own. It is rooted not merely in the biological past but in the historic past of the race. Its ways of functioning are determined not merely by inherited structures but by the experience of individuals with their ideas and plans, their sentiments and volitional patterns of action, within the matrix of the group in which they live. The conservation of energy takes a new form—the conservation of spiritual energy which may cumulate in geometrical progression. On the psychological level, life can redistribute energies in new ways, guided by conscious ideals, and thus to a considerable degree make over physical and biological conditions. That does not mean that we should conceive the psychological level as something apart from the life of the race. Rather it is a manifestation of the cosmic urge and the life urge for a completer and fuller realization. The life urge has created a new pattern relation, the psychological group, as it invented the pattern of the multicellular organism, for fuller responsiveness to the enveloping environment—not merely the physical and biological environments but the spiritual environment, the environment of thought, of beauty, of friendship. For these are as truly responses to the enveloping environment of a mind-endowed organism as the sense organs are adaptations to the specific physical energies of the environment. As the genius of life has been a long time improving its patterns of biological organization and adjustment, so it has been a long time in inventing and improving the patterns of psychological organization and adaptation, and the end is not yet.

If psychology is the study of behavior in psychological groups, as physics is the study of behavior in physical groups and biology in biological groups, we should be able to indicate the line

of demarcation between biology and psychology. But there is necessarily some overlapping. If the psychologist takes as his field such behavior as is guided by previous reaction, his domain would include behavior below the level where we can establish a psychological group and would overlap the field of the biologists. We may be aided by going back to St. Thomas Aquinas' distinction between adherent souls and separable souls. Learning by habit, as we find it in the lower stages of animal life and in the early stages of the learning process in the higher animals, must be regarded as an organic adjustment and therefore in St. Thomas' language adherent to the organic processes. Sporadic memory pictures may also be part of a particular vital process and form no connections among themselves. In revery and dreaming the memory pictures have liberated themselves from a particular vital want and form systems of their own with their emergent novelties, though the guiding field is still organic mood or feeling. Such syntheses do not necessarily involve a consciousness of group relations.

We have evidence of psychological group relations only where we discover expressive signs which bring about adjustment of individuals to one another. But even here the bond of unity may be biological rather than psychological, i.e., there may be no suggestion of the presence of a scheme in the consciousness of the participants. Where the signs are descriptive and not merely emotional reactions we can be sure that there is an intention to express something to those who can take account of the meaning of the expression and not merely act upon the expression. It is not easy to say where, in evolutionary development, a true psychological group emerges, but it is certain that adult human behavior, which is the subject matter of ordinary psychology, must be understood within specific psychological groups with their traditions and not just as interactions of biological organisms. On this level there may still survive adherent habits and adherent sporadic ideas, but life here in the main can be understood in terms of systems of meaning with their characteristic expression. Psychological systems are now "separable" in the sense that they can be studied as systems of meaning. They

are no longer "adherent" in the sense that they are part of particular biological impulses. Of course psychological systems are not "separable" in the sense that they could exist without the organism. They are rather expressions of the integral life of the organism at a new level. The organism is no longer a mere biological organism but a psychological organism.

Aristotle and St. Thomas were interested in the distinction between adherent soul and separable soul with reference to immortality. Aristotle thought that the functions of sensation, perception, memory and even general ideas were activities of the passive reason which is bound up with the organism and therefore perishes with the body. Only the active reason (*nous*) is independent of the body and therefore is eternal. But we cannot thus sharply distinguish between the passive reason and the active reason. Perception and memory may be the work of the active reason, i.e., they may be guided and organized by creative interest. St. Thomas was more nearly right in emphasizing the unity of psychological life, though he too regarded all animal souls as adherent to their bodies and therefore perishable. For him only the human soul is separable and immortal. With the problem of immortality we are not here concerned, but the question as to what is organic and what is psychological cannot be settled on such a wholesale basis. In one respect we sympathize with Aristotle and St. Thomas, viz. that where we find evidence of creative mental activity we have the surest line of demarcation between what is adherent to the organism and what can be studied on its own account. We must bear in mind, however, that in man habit may be a degeneration from higher activities, mechanized by repetition, and is not necessarily the result of the organic method of learning, as in the early stages of evolution, individual and racial.

Psychology has not as yet come to clear consciousness of its field. At present it is in a transition stage and is a hodge-podge of various tendencies and methods. Historically this is not to be wondered at. Psychology was for ages an adjunct to a rationalistic philosophy and is still largely reminiscent of this period, in spite of all its protestations. Its treatment of its ma-

In the last generation psychology has tried to appear more scientific by making itself an appendage to physiology. It has been thought that psychological processes can be explained by means of neurological processes and that it is more scientific to use the language of physiology than that of psychology. I have previously attempted to show the futility of such procedure. At present this means the explanation of the comparatively known by translating it into terms of the largely unknown. It should be possible to develop psychology within its own level of the psychological group. It is true that we must not ignore the biological background, but this background must be understood with reference to its outcome in man. The biological heritage has taken on the characters which fit it for the evolution of psychological individuals. If the brain has become largely a language mechanism, it is because a talking animal must be built for expression. Its whole behavior must be organized in terms of expression. When I say that psychology must become social psychology, I must not be understood to have reference to current social psychology. This is as artificial as the psychology of which it is the outgrowth. In fact it is more artificial. It shamelessly adopts certain concepts such as imitation or suggestion or instinct or adaptation and makes these do the work. It has had no conception of the group as its starting point and matrix. It is to anthropology rather than so-called social psychology that we are indebted for significant work at the present time.

In emphasizing the group I have not meant to minimize the creative function of the individual. If the individual is an abstraction apart from the group, so is the group an abstraction apart from the individual. While the group is not just an arithmetical assemblage of abstract individuals but a creative synthesis with emergent characters of its own, yet we must remember that the group is a synthesis of individuals and that the character of individuals conditions the quality of the group as truly as the character of the various atoms conditions the creative synthesis which is produced from them. It must be remembered too that creative advance must come through individuals. They are indeed conditioned by the matrix of the group and its

traditions, but they are not mere functions of the group. They can through their efforts change the group for better or worse. By means of ideal criticism and constructive endeavor they may indeed prepare the way for a higher type of group. And since the life urge must work through individual heredity as well as social heredity, a new quality of life may emerge prophetic of a higher man.

It is sometimes said that a personality is a gestalt. This is either a truism or misleading. A personality which fully integrates its environment into its specific structure is of course a gestalt. But such a personality is an ideal rather than a fact. Personality, as we know it, is process of adjustment within our group environment. In this process we must try to discover what our gestalt should be through creatively expressing it in the social milieu of which we are a part. There is not just one gestalt, plainly outlined for us. There are many possible patterns of living and it is for us to discover, through thoughtful experimentation, the pattern which will make harmonious realization possible. We are part, moreover, of the historic urge of life, with its pattern-creative activity, which stretches backward into an indefinite past and forward into an indefinite future, and our ultimate gestalt is hidden in the creative womb of the cosmos. It is by virtue of this *nisus* of life that, in the language of Emerson,[132] we are more than we are and are wiser than we know.

It is clear that if the electron and the atom owe their gestalt to the cosmic structure of which they are parts, so do organic and pschological individuals owe their gestalt to the cosmic whole in which they originate and function. The emergence of a personality in the matrix of nature is no more an accident than the emergence of an atom. There is indeed the particle aspect—the aspect of individual initiative and indeterminacy. Without this aspect in the organization of the energies of nature there would be no real novelty, no real creation. There would be merely the endless repetition of identical cycles which Stoicism envisaged. On the other hand, without a structure of the whole, indicating the viable patterns, indeterminacy would mean chaos. There

would be no direction in the activity of nature. From the point of view of structure there is a "law of unvarying total."[188] The levels of energy are established in the structure of the cosmos. This is the real law of conservation of energy. We cannot say in the concrete that "in every change that occurs the total consequents are exactly equal to the total antecedents."[118] This statement was possible in the old physics, but it is no longer possible. It appeared true in the old physics, because, if we take the large-scale transactions, we are able to make practically definite predictions on the basis of statistical averages. But the new physics has shown that, when we deal with the fine-grained entities of nature, we cannot predict their individual conduct, however carefully we may establish the conditions of the experiment. And since the large-scale entities of our ordinary experience are made up of the fine-grain entities, the indeterminacy must be present throughout nature and must influence the course of nature at the psychological level, as well as at simpler levels.

We can say, following the indications of physics, that the patterns are determinate in cosmic structure and that individuals must choose viable patterns if they are to persist and develop. This is as true on the organic and psychological levels as in the world with which inorganic physics and chemistry deal. There is a cosmic structure which prescribes the viable pattern of mind in the milieu of nature, as truly as there is a cosmic structure which prescribes the viable structure of matter. In Einstein's language, there is a directive geometry of space which determines one type of pattern as well as the other. But the individual is not obliged to choose a viable pattern. Here is where initiative and novelty come in. We may be assured, however, that the structure of mind is as truly part of cosmic structure as is the structure of matter and that they are ultimately aspects of one whole-control. Else how can mind discover the laws of the cosmos throughout all its levels? Yet we discover them not by necessity, but by creative initiative. This is the romance and the tragedy of the cosmos.

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PART III

CREATION

Chapter 7

ARTISTIC CREATION IN PLATO

We have examined two types of interpretation of the apparent order of nature—preformation and chance emergence. Preformation conceives the order as immanent in history from the beginning. History is merely the unfoldment of a form implied in the previous stages. At any rate there is no real novelty in the world of the preformationist, though there may appear to be novelty to the ignorant spectator. The theory of emergence, on the other hand, emphasizes novelty. New qualities, relations, values and individuals appear in the process. But the strict emergentist denies formal guidance of any sort. Things just happen by the mechanical interaction of the parts. Survival selection is the only arbiter of destiny. We must now examine a third type of interpretation. The theory of creation recognizes both formal guidance and emergence. There is novelty in nature, but there is also formative agency. The world is not just the result of chance, though chance may figure in the world, due to the indeterminacy of the parts. There is genius operative in the world to shape its course so far as the material permits. The theory of creation has its fountain, as well as its most convincing expression, in the great genius of Plato.

After venturing a cosmology of my own, as a result of many years of laborious research,[1] I had occasion to re-read Plato's *Timaeus*. To my great surprise, I discovered Plato's footprints everywhere over the ground that I had traversed. It was like Captain Scott getting to the South Pole and finding Amundsen's flag (though we must remember that Amundsen and Scott did not cover the ground in the same way). Perhaps I was biased by my interest. But we are all biased by our interests. There is no absolutely neutral interpretation. I was led to take a fresh survey of Plato to see how the *Timaeus* connects with Plato's development, so far as we can trace it in the dialogues; and became convinced that the cosmological point of

view is fundamental in Plato's thought and that the *Timaeus* was merely an attempt at articulate statement of a conception of reality which had been forming in Plato's mind during his whole constructive period, as distinguished from the period in which he was completely dominated by the personality of Socrates. In fact Plato's cosmological theory is, I think, his most distinctive contribution to philosophy and places him in the distinguished succession of Greek naturalists. The *Timaeus*, far from being the curious resurrection (for no particular purpose) of an obscure fifth century Pythagorean (as A. E. Taylor supposes), is the consummation of Plato's teleological speculation. I realize that it is audacious to enter a field which has been traversed by so many famous Greek scholars, but community of interest may furnish a better insight into the mind of Plato than minute technical learning, biased perhaps by a foreign tradition. It may be said of others more truly than of St. Paul: "Much learning hath made thee mad." It was Plato's theory that we see truth by the mind and not by mere details of sense nor mere halting opinion. And I shall try Plato's theory on his own philosophy.

We have sufficient direct evidence that Socrates had no interest in cosmology. In the *Apology* Plato makes Socrates refute the popular misunderstanding that he is "a curious person, who searches into things under the earth and in the heaven."[2] Socrates has no difficulty in finding witnesses to prove that he has "nothing to do with these studies." He speaks of such knowledge with Socratic irony as "superhuman wisdom." We have Xenophon's testimony to the same effect. Socrates "did not dispute about the nature of things as most other philosophers disputed, speculating how that which is called by the Sophists the world was produced, and by what necessary laws everything in the heavens is effected, but endeavoured to show that those who chose such objects of contemplation were foolish; and used in the first place to inquire of them whether they thought that they already knew sufficient of human affairs, and therefore proceeded to such subjects of meditation."[3] He pointed to the contradictions of the natural philosophers to show that it "is impossible for man to satisfy himself on such points."

Aristotle's testimony in regard to the interest of Socrates confirms that of the *Apology* and Xenophon: "Socrates, however, was busying himself about ethical matters and neglecting the world of nature as a whole but seeking the universal in these ethical matters and fixed thought for the first time on definitions."* Socrates, according to Aristotle, stopped with definitions. He did not affirm Platonic ideas.

Socrates is a typical fifth century humanist, like Protagoras concerned with human things and orthodox in his attitude to the popular religion. He believes in the godhead of the sun and moon. He accepts the oracle of Delphi as his authority and worships the gods in accordance with the laws of the land, without speculating about the gods. He has, moreover, an oracle of his own which he obeys absolutely. Socrates' scientific method exists in a different compartment from his religion. His scientific interest is in human nature; and through his new method of conceptual analysis, he becomes the creator of utilitarian ethics. This requires for him no speculative setting. The Pythagorizing of Socrates was posthumous. Socrates differed from the older sophists not in interest but in method. This method could not be confined to the limits fixed by Socrates for himself, and his accusers probably had the true instinct about the danger of this method to conventional religion and institutions. Unwittingly Socrates, moreover, gave a new content to religion through his own life.

The Development of Plato's Cosmology

Plato's young mind is naturally dominated by his reverence for Socrates. The ethical interest becomes pre-eminent for him too and remains so throughout his life. He accepts at first Socrate's method of induction from concrete instances to arrive at a common definition. But Plato discovered a new method

* *Metaphysics*, 987b, 1-4, Ross's translation. I see no reason for supposing that Aristotle misrepresents Socrates. He does not understand Plato because he is not a mathematician like Plato. But he is more closely akin to Socrates mentally than Plato is. We must remember that Aristotle had access to other members of the Socratic circle beside Plato, but no one has ever impugned Plato's historic veracity.

—the method of limits.* Whether he was led to this discovery by his mathematical interest or his ethical interest does not matter. It is equally applicable in either field. Mathematical ideals are never realized in the concrete world of existence. We find various curves, but we do not find straight lines or perfect circles. For the mind which has grasped the ideal, the lines which we draw are approximations and symbols, but the ideals must be grasped by creative intelligence, they cannot be perceived by sense. The same holds of the good and the beautiful. The good life is not completely realized in existent society or existent individuals. The perfect life, then, cannot be a generalization from existent lives. It must, like the mathematical ideals, be grasped by creative intelligence. Its significance does not derive from the varying existent lives, but these owe their significance to their approximation to the perfect. The convincingness of Plato's argument for the reality of the world of form depends upon the qualitative distinction between the method of reason and that of opinion which proceeds from particulars. Reason grasps "principle which is above hypothesis, making no use of images, . . . but proceeding only in and by the ideas themselves," "not the visible forms, but the ideals which they resemble, . . . the absolute square and the absolute diameter, . . . really seeking for the things, which can only be seen by the eye of the mind,"[4] as constrasted with the tentative form of knowledge which is gained by perception and opinion. "If mind and true opinion are two distinct classes, then I say that there certainly are these self-existent ideas unperceived by sense, and apprehended only by the mind."[5]

It was Plato's discovery of degrees and of limit which made it impossible for him to stop with the Socratic concept. If form were completely immanent in the concrete individuals, inductive generalization would be sufficient. But there is another type of similarity, Plato tells us in the *Phaedo*,[6] than that which suggests identical qualities in individuals, and which is employed in generalization, namely similarity which suggests

* Limit is here used in the sense of modern mathematics, not in the Pythagorean sense of the limit as opposed to the unlimited.

defect and approximation. For this type of relation another method is required. Aristotle never understood the method of limits. Hence Plato's ideas for him are merely hypostasized abstractions. He goes back to the Socratic method of induction. The form is conceived as immanent in individuals and must be predicated of individuals who are the real substances. "Nature works by a law immanent in itself." But Aristotle is not consistent. While nature "is always striving after the most beautiful that is possible," she is not quite successful. In the world of change, form is never completely realized. But what sort of immanence is it which is not quite immanent? The Stoics were the only consistent immanentists and that meant pantheism.

The teleological conception of the good (which Plato adopts from Socrates) and the method of limits conspire to force Plato into cosmology. Socrates' conception of cosmology as "supernatural wisdom", forbidden to man, makes Plato hesitate to make the venture into cosmology. But if the world of being—the world of structure, of meaning and worth—is to be understood in terms of ends or purposes, and if it cannot be projected merely on the plane of human experience as Socrates had done, reality must somehow have a teleological structure. With Plato's teleological background it was impossible for him to divorce being from soul and mind. A teleological cosmology is called for. But there can be no universal teleology unless it can be shown that there is a cosmic creative genius which plays the rôle on a large scale that our mind plays on a small scale in art and society. If we could see the universe from the point of view of the Creator, we should understand all. For we can only understand truly when we understand as the Creator understands. In this St. Thomas Aquinas is in agreement with Plato.

While Plato was hesitating on the threshold of cosmology, he discovered Anaxagoras. The enthusiasm with which Plato makes Socrates speak in the *Phaedo* is entirely inconsistent with an autobiography of Socrates, who is too anxious to prove that he never concerned himself with cosmology and who had, according to Xenophon and Plato's *Apology*, a religious prejudice

against it to the end of his life. Can we imagine Socrates, with his bias against natural science, feeling the thrill that Plato felt? As a confession by Plato it throws light upon his whole subsequent philosophy. It is not necessary to suppose that Plato had never heard of Anaxagoras' book before, but we never discover another man's thought until our own research leads us in the same direction. We may be sure that Socrates had not encouraged the reading of Anaxagoras, for to Socrates the teaching that the "moon is earth and the sun is a red hot stone" must have seemed impiety. At any rate Plato had a real thrill when he discovered that Anaxagoras had been working at the same problem and that he had made mind, *Nous*, a cosmic principle, responsible for the order of the world.

So Plato bought the book and read it eagerly. It began well: "*Nous* had power over all things, both greater and smaller, that have life. And *Nous* had power over the whole revolution, so that it began to revolve in the beginning. And it began to revolve at first from a small beginning; but the revolution extends over a larger space and will extend over a larger still. And all the things that are mingled together and separated off and distinguished are all known by *Nous*. And *Nous* set in order all things that were to be and that were, and all things that are not now and that are, and this revolution in which now revolve the stars and the sun and the moon, and the air and the ether that are separated off."[7] Surely a splendid promise. Now he would show, thought Plato, that "if mind is the disposer, mind will dispose all for the best, and put each particular in the best place."[8] But Plato's hopes were grievously disappointed: "As I proceeded, I found my philosopher altogether forsaking mind or any other principle of order, but having recourse to air, and ether, and water, and other irrational things."[9] Anaxagoras' *Nous* was too thin and impersonal for Plato. Anaxagoras had lost sight of the ultimate cause in the secondary causes.

What Plato required was a teleological cosmology. He wanted to arrive at a conception of the ultimate cause or reason (αἴτιον, *Ursache* or rather *Zweckursache*) which disposes with a view to the good. "This is the principle I would fain learn if anyone

would teach me. But as I have failed either to discover, or to learn of anyone else, the nature of this principle or its working, I will show you what I have found to be *the second best mode* of enquiring into the cause."[10] It is plain that Plato realized when he wrote the *Phaedo* that the cosmological approach is the only true approach, if we would understand reality; and that cosmology must be conceived teleologically as the creative activity of the supreme genius who works to realize the fairest and best. He did not find a satisfactory cosmology and was not ready to suggest one. But his mind was at work on the problem. Like young Hume he made notes, at least mentally, towards a natural theology. More than that, the cosmological approach is ever with him, as is apparent from hints in various dialogues.

A short cut would have been mysticism—the contemplation of the inexplicable, the adoration of the unknowable. But that would have been "to lose" the eye of the soul.[11] Plato is looking for the intelligible, not for an emotional intoxication. He, therefore, chooses the realm of forms with its implications as *"the second best"* (not having a satisfactory cosmological theory as yet), for his field of investigation. Without being able to account for the cosmos he can investigate the nature and implications of ideas. Plato already in the *Phaedo* indicates the main line of research of the Academy, viz. mathematics. But Plato was already conscious of the fact, which he makes explicit in the sixth and seventh books of the *Republic,* that mathematics cannot give us final truth. Plato describes his method: "This was the method which I adopted: I first assumed some principle which I judged to be the strongest, and then I affirmed as true whatever seemed to agree with this, whether relating to the cause or anything else; and that which disagreed I regarded as untrue."[12] What Plato did was what Descartes was later to do. He tried to arrive at an idea which seemed indubitable—clear and distinct. Then he developed the implications of that idea. It is the method of geometry to which both Plato and Descartes contributed. It is the method pursued by E. V. Huntington in developing a geometrical system from the concept, between. But the ancient

geometricians, including Euclid, felt that they were investigating nature, while the modern geometricians are concerned merely with logic. Until Einstein came on the scene, it seemed that Euclidean geometry was the geometry of nature. But now it is regarded merely as a system of logic. For Plato the investigation of the implications of ideas is an investigation of the structure of reality, though it is only "a second best" since it does not give us the ultimate rationale of nature.

While Plato approaches reality through the investigation of structure—ideas, forms, meanings—he denies emphatically that he is farther from reality than he "who turns to the immediately given things."[13] On the contrary he who deals with things as they appear is farther away from reality than he who interprets phenomena from the point of view of structure. In the *Sophist* Plato contends against those who "maintain that only the things which can be touched or handled have being or essence, because they define being and body as one, . . . and will hear of nothing but body."[14] We can never by the senses attain to a grasp of structure, we can only arrive at opinion—tentative guesses, probability. If we start with structure we can see that the world of perception participates in the world of structure in that the former expresses structure in however broken a way, as language is a medium for expressing ideas, though an inadequate medium. But the sensible world is not separated from the intelligible. The world of appearances suggests structure to a mind which creatively apprehends structure. Thus in the *Symposium* the world of perception, the world of scientific hypothesis and the world of institutional organization suggest progressively the limit—the absolute beauty. They would not suggest it to creative intelligence, if they did not by degrees reveal it in spite of the distortion of the medium, as the rays of moonlight are revealed on the ruffled mirror of the lake.

There can be no doubt that Plato had set himself a legitimate field of research; and by pursuing it he not only furthered the logic of geometry but was largely instrumental in laying the foundations of logic itself. But there are dangers in the method. There is the danger that an idea which seems indubitable may

seem so because of "the intellectual climate" (to use a phrase by William James). It may not prove indubitable to others. Thus the Platonic circle assumed as indubitable "that there is an absolute beauty and goodness and greatness and the like".[15] Things therefore are beautiful only so far as they partake of absolute beauty. Such ideas have not seemed indubitable to other thinkers. There is the further danger that there may be error in developing the implications of an idea. Plato was conscious of both dangers: "First principles, even if they appear certain, should be carefully considered; and when they are satisfactorily ascertained, then, with a sort of hesitating confidence in human reason, you may, I think, follow the course of the argument."[16] There is a still greater danger when it is assumed that the investigation of the implications of ideas is an investigation into the structure of nature. This danger is illustrated by Plato's use of the principle of implication in order to prove the immortality of the soul. If we assume the eternity of the principle of life, and if the soul participates in the principle of life as the individual number, three, participates in oddness, so that the soul always brings life with it as three brings oddness, then soul must be immortal. But if we doubt the eternity of the principle of life or doubt the analogy of the soul to numerical individuals, then the argument fails. In the *Timaeus* Plato makes it clear that it is not enough that an hypothesis in regard to nature is aesthetically satisfying. It must also be capable of standing the pragmatic test.

In the *Symposium*, Plato has become definitely conscious of the implications of the new method and of the difference between his conception of ideas and that of Socrates. Seeing that it was inappropriate to make Socrates the spokesman for the new doctrine, Plato introduces the mythical Diotima—an oracle, who therefore could talk of the future as present—to instruct Socrates. Socrates was familiar with the lesser mysteries—temperance and justice as they are concerned with states and families—but he knew nothing about beauty, "absolute, separate, simple, and everlasting,"[17] which reveals itself in the perishing beauties of earth and is suggested by them but which has a

status of its own. So far from the principle of beauty being derived from the concrete changing things of perception, we must understand these through it. It can be contemplated by the mind only. It is the source and inspiration of creative activity. Our education in beauty must start, it is true, with the appreciation of beauty in the concrete, as our study of geometry starts with concrete figures, but this becomes merely symbolic of the true beauty. This absolute beauty is imparted somehow to the world of perception. It is when by an act of creative thought we grasp the limit, the integral of the series, that we can understand the grades of approximation—perception, opinion, science, institutions—but we cannot derive the limit from the series. The limit integrates the series. If we disintegrate the integral, to use modern language, we can never arrive at it by analytical steps. It is a synthetic act, and the comprehension of the series is a synthetic act.

The method of limits points in a different direction from the method of generalization. The limit has a dignity superior to that of the approximations. It is the limit which has "being" *par excellence*. But does the limit—the straight line, the perfect circle, the structure of beauty—exist merely in our mind? Or does it have existence in nature, independently of our mind? In the *Parmenides* Plato definitely rejects the subjective alternative. The mind grasps the limit as objective, as legislative. Since such is the case, how does the limit exist in nature? It is certain that the limit, the idea, exists independently of the concrete temporal imitations. It is not presented to sense, but must be grasped, if at all, by creative thought. But while "there certainly are these self-existent ideas unperceived by sense and apprehended only by the mind,"[18] what is their status in reality?

On one thing Plato is clear from the *Symposium* to the end; and that is that the structure of nature can be grasped only by creative intelligence. In this Plato is in substantial agreement with the great naturalist, Democritus, who holds that it is only by the organ of reason that we can know the ultimate nature of things. We can never attain to such knowledge by custom

which stops with the appearances of the senses, though the senses, according to Democritus, may retort: "Poor mind, it is from us thou hast got the proofs to throw us with. Thy throw is a fall."[19] However, what Democritus regards as the arrangement in nature, Plato regards as "order only by accident." It does not follow from principle. We must, I think, agree with Plato, that the structure of nature can be grasped only by the mind. The two great structural hypotheses of present science are the best vindication of Plato. I am referring to Clerk Maxwell's electromagnetic theory and Einstein's general theory of relativity. Neither theory was an induction from evidence, but rather an anticipation of evidence. Bertrand Russell thinks that the grounds which Clerk Maxwell gives for his theory are so flimsy that he must have arrived at his equations by intuition. And Einstein's theory is a marvellous prediction of evidence which could of course not be looked for until the theory was complete. Both thinkers were doubtless stimulated by the logic of scientific development. But the creation itself was an act of intuitive genius. It was in the Platonic spirit and in Platonic language that Einstein is said to have replied to the reporters who were eager to get his reaction to the news that a two hundred inch reflecting telescope was to be erected in California: "Not the eye but the spirit furnishes the proof of theories—and that errs most of the time." Plato and Einstein would agree that the spirit is far from inerrant, but by it alone can we divine the structure of nature. Mere induction from particulars can furnish us only statistical averages. But statistical averages are a poor substitute for creative genius.

If it is by intuition that the mind divines the structure of nature, how can we account for the intuition? Plato in the *Phaedo* refers in mythical fashion to the explanation by recollection from previous existence. But this merely pushes the problem further back. The structure of mind which leads it to create structure—logical structure, aesthetic structure, ethical structure—must be due to reality itself. The metaphysical bent of Plato's mind is too strong for him to stop with the consideration of abstract structure. Other minds have found this a satis-

factory stopping-place. But Plato must press on to consider the rationale of the structure of the human mind—the source of its intuitive creativeness.

In the *Phaedrus,* Plato is conscious that the investigation of structure is an investigation of reality, not a subjective nor a merely formal procedure. "If I find any man who is able to see unity and plurality in nature, him I follow, and walk in his steps as if he were a god."[20] He is now able to give a realistic explanation of intuition or "recollection". In a mythical way he shows that the mind's intuition of structure is due to rapport with the structure of reality. "The colourless and shapeless and intangible essence is visible to the mind, which is the only lord of the soul."[21] The mind when liberated from the thraldom of material interests through rigid moral discipline has first-hand experience of the limit. "Of beauty, I repeat again, that I saw her there shining in company with the celestial forms." And having grasped structure with the mind and "coming to earth, we find her here too, shining in clearness through the clearest aperture of sense. For sight is the clearest aperture of our bodily senses."[22]

The appreciation of beauty seems to Plato in the *Phaedrus* to be the most convincing experience of ultimate structure. "Beauty only has this portion that she is at once the loveliest and the most apparent." But we must have the intuition of absolute beauty before we can grasp beauty in the concrete world. The mind must have structure to recognize structure. It is because the mind brings the sense of structure that it can discover structure by induction. "Man ought to have intelligence, as they say, 'secundum speciem,' proceeding from many particulars of sense to one conception of reason; and this is the recollection of those things which our soul saw when in company with God —when looking down from above on that which we now call being and upwards towards true being."[23] Like Kant Plato sees that mind must bring structure to experience in order to discover structure. But Plato shows his superior sanity in realizing that the structure of the human mind cannot be conceived in

isolation from reality, but must be understood in community with reality. It is ontological structure which the mind intuits; and the discovery of structure, so far as it is true discovery, is the discovery of the structure of nature.

Plato recognizes that it is in the realm of ontological ideals that the mind finds God. In the *Symposium* he tells us that it is in the life of creative communion with absolute beauty that man becomes the friend of God and becomes immortal, if mortal man may.[24] In the *Phaedrus* he tells us that the philosopher "is always, according to the measure of his abilities, clinging in recollection to those things in which God abides,"[25] and in beholding these things the mind is assimilated to God—a conception to which Plato recurs in the later dialogues. It is in our striving for ideals that we become God-conscious. This implies that God is the perfect embodiment of ideals. But there is no hint in the *Phaedrus* of God as creator.

Plato, however, has taken a distinct step towards a cosmology in making the soul the ultimate cause of motion. This step is taken not in the interest of theology but in the interest of immortality. "The soul is immortal, for that is immortal which is ever in motion; but that which moves and is moved by another, in ceasing to move ceases also to live. Therefore, only that which is self-moving, never failing of self, never ceases to move, and is the fountain and beginning of motion to all that moves besides. Now the beginning is unbegotten, for that which is begotten has a beginning. . . . But that which is unbegotten must also be indestructible; for if the beginning were destroyed, there could be no beginning out of anything, or anything out of a beginning, and all things must have a beginning. And therefore the self-moving is the beginning of motion; and this can neither be destroyed nor begotten, for in that case the whole heavens and all generation would collapse and stand still, and never again have motion or birth."[26] It will be seen that having started to prove the immortality of the soul from its self-movement, Plato is swept on by his imagination to make the soul the only principle of motion and therefore the ultimate cosmic principle

of motion.* In the *Timaeus* he recognizes with the naturalists that matter itself has the property of motion, but in the *Laws* he comes back to the *Phaedrus*. It should be noted that in the *Phaedrus* it is soul, and not mind, which is the originator of motion, as contrasted with Anaxagoras in the *Phaedo*. Mind is now conceived as "the sole lord of the soul." We have here the idea that mind must exist in soul to be effective. This is the presupposition of the later dialogues. In the *Timaeus* the relation is stated in terms of creation. God put mind in soul and soul in body. It must be clear now that Plato has made considerable advance in his cosmological speculation from the *Phaedo* to the *Phaedrus*. The logic of his system required a cosmology. The intuition of structure in the mind must be accounted for. And this meant accounting for the relation of mind and soul to the cosmos.

It is customary to associate the *Phaedrus* with the *Symposium;* and there seems to be a close kinship between Socrates' speech about the lover in the *Phaedrus*[27] and Socrates' speech (or rather Diotima's speech to Socrates) on love in the *Symposium*.[28] But I have been perplexed by the affinity of the speech on the immortality of the soul[29] with the *Laws*. It is only in this speech and the *Laws* that the soul is made the ultimate principle of motion. The argument for the immortality of the soul is obviously an interpolation where it stands. It has its own ending ("Enough of the soul's immortality."); and the speech on the lover would be complete without it.

There is at present a considerable prejudice against Plato's having revised his dialogues after they were once written. But I think that is due to the fact that commentators are rarely creative writers. Any creative writer knows that so long as he has control of his manuscript, he is continually revising it as new ideas come into his mind. This revision necessarily stops with printing unless there is opportunity for a new edition. We

* Since, however, Plato is talking about directive motion, he is not necessarily denying the existence of primitive non-directive motion. Only the soul is self-moving; the motion of matter is externally communicated from part to part. It is dependent upon being "moved by another". Cp. *Timaeus*, 58.

know how Kant revised the *Critique of Pure Reason* in his second edition—not to speak of the various changes in the process of writing the first *Critique* as indicated by his notes. Plato was in the favorable position of always having control of his manuscripts; and from his scrupulous care in destroying his early poetry, we may be sure that he destroyed the earlier drafts of his dialogues, when they no longer satisfied him. A prose poem like the *Apology* or the *Symposium* would have an aesthetic completeness of its own. But dialogues involving cosmology would naturally suggest revision with the progress of Plato's thought.

To return to the *Phaedrus,* we must remember that this is a dialogue on rhetoric and not a dialogue on love. The speeches at the beginning are given as specimens for analysis. It is obviously not necessary to suppose that they belong to the temporal epoch of the writing of the dialogue. Two speeches are taken up for comparison, one by Lysias and one a prose poem by Plato, of uncertain date. It is very probable that the dialogue itself was written to preserve this poetic jewel, like a diamond set in gold. If so, Plato was certainly successful in his purpose. But posterity has been so enamoured with the jewel that it has neglected the setting—the most brilliant discourse on rhetoric ever written. There are several indications that the dialogue on rhetoric as it stands is very late. Plato maintains that a true orator must have mastered metaphysics. "And do you think that you can know the nature of the soul intelligently without knowing the nature of the whole?"[80] Plato could scarcely have laid down this requirement before he had worked out his own cosmology. He gives Pericles as an example of how the real orator is made. "All the higher arts require much discussion and lofty contemplation of nature; this is the source of sublimity and perfect comprehensive power. And this, as I conceive it, was the quality which, in addition to his natural gifts, Pericles acquired from his happening to know Anaxagoras. He was imbued with the higher philosophy, and attained the knowledge of mind and matter, which was the favorite theme of Anaxagoras, and hence he drew what was applicable to his art."[81] The reverent tone in which Plato refers to Anaxagoras

is in marked contrast with the irony of the *Phaedo*, and is like the attitude of the *Philebus*.[82]

Plato's interest in composition for its own sake probably represents a fairly late stage in Plato's writing. It has been pointed out by scholars that Plato's style in the later dialogues shows the influence of Isocrates. In the *Phaedrus* Plato takes occasion to express his indebtedness to Isocrates.[83] Since he expresses this indebtedness through Socrates, it is necessary for Plato to pay his tribute as a prophecy, though Socrates would have had to be a clairvoyant to have foreseen the genius of Isocrates from the amateur productions which might have been available to him. That Plato had in mind such dialogues as the *Sophist* and the *Statesman* is clear from his reference to his "great love of the processes of division and generalization"[84] which follow "the natural ideas or members, not breaking any part as a bad carver might." He also makes clear that this division has to do with "unity and plurality in nature", i.e. has metaphysical import. Plato's love of division is exhibited preeminently in the *Sophist* and the *Statesman*. The philologists* may therefore be on the right track, when placing the *Phaedrus*, as it stands, among the later dialogues. If we consider Plato's opportunity for revision, it is evidently futile to assign a rigid succession to Plato's dialogues.

In the *Theaetetus* Plato (according to Burnet) for the first time in the history of Western philosophy explicitly introduces God as a philosophic principle and for him the ultimate principle. "In God is no unrighteousness at all—he is altogether righteous. . . . To know this is true wisdom and manhood, and the ignorance of this is too plainly folly and vice."[85] Henceforth Plato's philosophy becomes theocentric. The mystical God of Socrates has become the basic cosmic principle. Plato now conceives of the pattern of the good life as existing in the very nature of things: "There are two patterns set before them in nature; the one, blessed and divine, the other godless and

* See articles by Andrew Fossum, July, August, September, 1931, in *The American Journal of Philology* on "Hapax Legomena in Plato" (vol. L II, 3, whole no. 207). This is a statistical study, based upon all the unusual words in Plato.

wretched; and they do not see in their utter folly and infatuation, that they are growing like the one and unlike the other, by reason of their evil deeds; and the penalty is, that they lead a life answering to the pattern which they resemble."[36] But Plato does not throw any light in the *Theaetetus* on the relation of the pattern in nature to God.

We must not assume, however, that the *Theaetetus* as it stands can be given a definite date. The reference to elements as letters recalls the *Timaeus* and the digression on the philosopher (172-177) is strangely suggestive of the *Laws* in its dualism of good and evil: "Evils, Theodorus, can never pass away; for there must always remain something which is antagonistic to good. Having no place among the gods in heaven, of necessity they hover around the mortal nature and this earthly sphere"(176). Here evils seem to be personified. The picture of two "examples" set before us in nature gets cosmic meaning if Plato had in mind an evil soul or souls as cosmic forces such as he postulates in the *Laws*. He could scarcely speak of the "necessity" of the *Timaeus* as an "example". The atmosphere of the digression suggests the sort of rambling that Plato excuses in the *Laws* on the count of old age and is suitable in the *Theaetetus* to the old age of Theodorus.

The *Gorgias* must, I think, be taken as a prologue to the *Republic,* with which it agrees in substance. The *Gorgias* is at any rate a long distance from the *Protagoras*. While the *Protagoras* is a brilliant statement of the doctrine of quantitative hedonism, which found its modern advocate in Jeremy Bentham, the *Gorgias* anticipates the qualitative hedonism of John Stuart Mill, though more rationalistic and satisfying than the latter. We must take account of the quality of pleasure and not merely of its quantity. There are bad pleasures as well as good pleasures; and, therefore, pleasure cannot be identified with the good. As in the *Republic,* everything, including pleasure, is subordinated to the highest good. The good life must be viewed as an organic whole, with inherent harmony and measure. The good is identified with justice and health in the individual life and in the state. Justice holds for gods and men, for the next life as well as

for this. The essential features of the eschatology of the *Republic* are given in the myth at the end of the *Gorgias*. But what concerns us is that the good has metaphysical as well as human significance. "The virtue of each thing, whether body or soul, instrument or creature, when given to them in the best way, comes to them not by chance, but as the result of the order and truth and art which are imparted to them. Yes, I say. And that which makes each thing is the proper order inhering in each thing."[37] Here Plato generalizes the conception of virtue, so as to apply universally. In the sequel, Plato brings out more expressly the cosmic implication of this generalization of virtue: "Now philosophers tell us, Callicles, that communion and friendship and orderliness and temperance and justice bind together heaven and earth and gods and men, and this universe is therefore called Cosmos or order, not disorder or misrule, my friend. But although you are a philosopher you seem to me never to have observed that geometrical equality is mighty, both among gods and men: you think that you ought to cultivate inequality or excess, and do not care about geometry."[38] Here Plato indicates that the ethical problem is bound up with the cosmological problem. We have the conception of the universe as a moral Cosmos.

In the *Republic,* Plato affirms explicitly and emphatically that the teleological point of view is the only true point of view. This is now spoken of as a familiar point of view. "For you have often been told that the idea of good is the highest knowledge, and that all other things become useful and advantageous only by their use of it."[39] This idea is innate in the sense that every one has "a presentiment that there is such an end" and that every one in his heart seeks to realize it, not being satisfied to possess the appearance as with many other things, including even justice and honour, but wanting the reality. But while every one has a presentiment of this end, few possess true insight. Those that have the "true notion without intelligence", are "only like blind men finding their way along a straight road".[40] It is of the utmost importance that those who are guardians of the state should be clear about this first principle.

Socrates declines, however, to enter into an analysis of "the actual nature of the good, for to reach what is in my thoughts now is too much for me in my present mood".[41] Socrates' soul must go marching on for some years yet, before he attempts such an analysis in the *Philebus*.

Without entering upon a logical analysis of the good, we can grasp its significance from a functional point of view. We can know "the child of the good". We can see its relation as the first principle to the whole hierarchy of ideas and activities which get their value and meaning from it. "Now, that which imparts truth to the object and knowledge to the subject is what I would have you term the idea of good, and that you will regard as the cause of science and of truth as known by us."[42] Since the ultimate question must always be: Is it worth while? therefore that which is conceived as making any idea or activity worth while takes precedence. It has a place higher than truth and knowledge. It is more beautiful than either, for everything derives its beauty from it. There is a close affinity between the idea of the good in the sixth book of the *Republic* and the absolute beauty in the philosophic poem of the *Symposium*. In either case the limit makes significant the series of approximations. The good is always the most beautiful, though Plato does not say in the *Republic* that the idea of beauty exhausts the good. In either case we must remember that we have to do with objective structure. The idea of the good in the *Republic* is the structure of the real world. To grasp the meaning of the world is to see it from the point of view of the good. And there is a pattern laid up in heaven of the good state, i.e. the viable structure of the state is indicated in the structure of reality. The rulers of the state must be philosophers because they must have a grasp of what is for the best.

I do not think there is anything mystical (in the technical sense) about Plato's idea of the good in the *Republic*. Since the idea of the good is the first principle, everything is subordinated to it. But the good is not something occult as the Neoplatonists supposed. We are told that the Socratic principle "that the good is the useful" is "the best of sayings". Plato is

consistent throughout his dialogues that "the good is what profits men". The structure as well as the content of the good can be grasped by reason. Reason can rise to the first principle "by the power of dialectic, using the hypotheses not as first principles, but only as hypotheses—that is to say steps and points of departure into a region which is above hypotheses, in order that she may soar beyond them to the first principle of the whole; and clinging to this and then to that which depends on this, by successive steps she descends again without the aid of any sensible object, beginning and ending in ideas".[43] Plato assumes that the teleological hierarchy of ideas is also a logical hierarchy, though he does not work out the details. He maintains further "that knowledge and being which the science of dialectic contemplates are clearer than the notions of the arts, as they are termed, which proceed from hypotheses only". The statesman, moreover, "must raise the eye of the soul to the universal light which lightens all things, and behold the absolute good; for that is the pattern according to which they are to order the state and the lives of individuals, and the remainder of their own lives also, making philosophy their chief pursuit".[44] Plato believes that we enter most fully into reality when we are most fully awake, not when we go into a trance. We are the most sane when we see things from the point of view of the whole, and this for Plato means to see things from the point of view of the good, or what is best.

The later mysticism has its origin in a fateful metaphor. Plato compared the good to the sun. The analogy is that as the sun is the author of the visibility of all things in the world of sense, so the good makes meaningful everything in the world which mind contemplates. This is only a metaphorical way of saying that the idea of the good is the first principle or that reality is ultimately teleological. So far from the relation of the idea of the good to that below it being mystical, it is supposed by Plato to be a relation of strict logical implication. That Plato should wax enthusiastic about his first principle is not to be wondered at. It was through the conception of the good that Socrates by a stroke of genius had created the science of Ethics—the first

science to be created. This principle has shown a marvellous power of bringing clarity and unity into the motley facts of human life. For Plato the idea of the good would explain with equal clarity the seeming confusion in the cosmos could we follow its implications. If Kant is unable to refrain from apostrophizing the abstract concept of duty, certainly Socrates or Plato has a right to apostrophize the first scientific principle discovered by man and the most practical—the idea of the good.

There is another sense in which Plato—carried away by his metaphor—uses the good, namely as the creative agent and not merely the first principle. As "the sun is not only the author of visibility in all visible things, but of generation and nourishment and growth, though not himself a generation, . . . in like manner the good may be said to be not only the author of knowledge in all things known, but of their being and essence, and yet the good is not essence but far exceeds essence in dignity and power".[45] The *idea* of the good, Plato points out, may be called the essence of the many good. When he makes the good the creator of essence he cannot have in mind the idea of the good, which is itself an essence, though the highest. In the tenth book we are told that *God* is the creator of all the patterns in nature*—of the bed and the table and all other patterns.[46] And they are all created for the good.

What is the relation of the good to God? According to the second book of the *Republic*, "God is always to be represented as he truly is". He is to be represented therefore as "truly good". And "the good is the advantageous" and "the cause of well-being". But not everything that happens in our world is good. "The good is not the cause of all things, but of the good only, and not cause of evil." We can now see the relation of God to the world as it is: "Then God, if he be good, is not the author of all things, as the many assert, but he is the cause of a few things only, and not of most things that occur to men; for few are the goods of human life, and many are the evils, and the good only is to be attributed to him; of the evil other causes

* The reference to God as creator suggests the *Timaeus*. Evidently God did not use pre-existent patterns.

have to be discovered." Here God is defined as "truly good"; but Plato does not here expressly speak of the good and God as identical. It is to be noticed that in the *Republic* Plato takes a pluralistic view of reality. He has already in mind an "errant cause."

What Plato's teleology required was a cosmic mind (and soul) which creatively gives order, beauty and worth to the changing world which we call existence. This conception he has suggested in the *Republic*. This conception of a cosmic artist he takes for granted in the *Sophist*, though it should be noted that it is new to the young interlocutor: "Let me suppose then that things which are made by nature are the work of divine art, and that things which are made by man out of these are works of human art. And so there are two kinds of making and production, the one human and the other divine."[47] The divine artist creates the patterns which we try to express in material form.

The real antagonists Plato now feels to be the materialistic naturalists who deny order and meaning in nature: "Looking, now, at the world and all the animals and plants which grow upon the earth from seeds and roots, and at inanimate substances which form within the earth, fusile or non-fusile, shall we say that they come into existence—not having existed previously—in any way but by the creation of God, or shall we agree with vulgar opinion about them?" The vulgar opinion is "that nature brings them into being from some spontaneous and unintelligent cause". Materialists to-day would say that they emerge. Plato's opinion, expressed through the Eleatic stranger, is that "they come from God, and are created by divine reason and knowledge".[48] He supposes that "we, and the other animals, and the elements—fire, water, and the like—are known by us to be the realities which are the creation and work of God".[49] In short, nature is divine art and human art is "image-making".[50]

Plato conceives of reality as a living dynamic whole. Even in the *Phaedo* where he despairs of cosmology and selects the study of structure—the implications of ideas—as his field of re-

search, he regards this as a half-way house, *a second best*. The true view would be the cosmological creative point of view, if we could have it. But the logic of Plato had become formalism in the second rate minds which tried to follow him. It is one of the ironies of history that the creator of ideas should have to fight against his own creation. In the *Parmenides* Plato shows the futility of abstract ideas by setting the Eleatic formalists against the Pythagorean, like Kilkenny cats, to their mutual destruction. A more brilliant indictment of formalism has never been made. But Plato, unlike Bradley, does not fall into mysticism in which "all cows are grey". The alternative is a thoroughgoing ethical or aesthetic idealism. In the *Sophist* Plato proceeds more constructively to show the functional character of ideas. He is more tender toward those who contend that true essence consists in "intelligible and incorporeal ideas," existing apart, than to the materialists, for the former are of his own school. But he is none the less emphatic against separating ideas from the living whole: "And, O heavens, can we ever be made to believe that motion and life and soul and mind are not present with absolute being? Can we imagine being devoid of life and mind, and to remain in awful unmeaningness an everlasting fixture?"* Nor can we separate the world of appearances, the world of change, from the world of structure. The latter reveals itself in the medium of the former, though it be as broken lights. This Plato had maintained from the *Symposium* on. Yet Plato had become identified in the minds of some of his own followers with formalism. The Academy continued the false tradition after Plato's death. Aristotle bases his criticism *ad nauseam* on this misconception. And the historic tradition has represented Plato's world of being as a world of abstract forms. When A. E. Taylor represents Plato as implying with Whitehead the impersonal ingression of abstract eternal objects into the world of events, he shows that he has missed the

* *Sophist*, 249. Whatever may be the drift of the *Parmenides*, Plato certainly sets himself to destroy the hypothesis of self-existent and separate ideas. Parmenides shows the absurdities to which such an assumption leads. (132.)

essential conception of dynamics in Plato which is always the activity of soul endowed with mind, in short is personal.

The *Statesman* has been overshadowed by the greater work, the *Republic,* and has never received much attention. There are certain affinities of the *Statesman* with the the sixth and seventh books of the *Republic,* which suggest to me at any rate that the sixth and seventh books may have been written after the *Statesman.* There is no reference to the sixth and seventh books of the *Republic* in Socrates' summary at the beginning of the *Timaeus,* and we may assume that the sketch of the *Republic,* as it then stood, did not contain these books. At the beginning of the *Sophist* Plato promises three dialogues: one on the sophist, one on the statesman and one on the philosopher. We have the dialogues, the *Sophist* and the *Statesman,* but no dialogue, the *Philosopher.* My surmise is that Plato found it desirable to combine the rôle of the statesman and the rôle of the philosopher and incorporated this synthesis in the sixth and seventh books of the *Republic.* Plato always regarded the *Republic* as the model of the ideal state, though he made concessions to the historic life of man in the *Laws,* in order to furnish a usable constitution.

As against the prevalent interpretation that God was confronted in creation by an independent world of essences, it is interesting to note in the *Statesman* the emphasis on creative personality as superior to all laws and forms. The ideal statesman is compared to the Creator of the world. "The best thing of all is not that the law should rule, but that a man should rule, supposing him to have wisdom and royal power."[51] The ideal statesman is above laws and creates the laws that are suitable to the conditions of man. This is the ideal condition which is *like divine providence,* while in the second best condition the rulers are bound by the established laws, which may or may not be suitable. We are reminded of the statement in the sixth book of the *Republic* that the Good is above essence and is the creator of essence; and the statement in the tenth book of the Republic that God is the original creator of all the forms. In the *Laws* Plato has come to the conclusion that the second best

—the government by law—is the only thing immediately practicable. So he projects a constitution for the second best state.

In the *Statesman,* the metaphysical bent of Plato's mind is evident. Even though he is treating of such a human subject as politics, he is alive to the need of seeing everything in its cosmological setting. The problem of the greater and less and the mean is not merely a human problem but a cosmological problem. Our relative measurements imply an absolute standard: "The art of measurement is universal, and has to do with all things" and a man must first see "the unity of things", and should go on "with the enquiry and not desist until he has found all the differences which exist in distinct classes, nor should he rest satisfied in the contemplation of the innumerable diversities of kinds until he has comprehended all that have any affinity to each other within the single class, notion, or essence."[52] We must rise to a view of the whole. And, therefore, in our inquiry about the statesman, we must improve our knowledge of philosophy generally, as well as our knowledge of politics. We must investigate knowledge for its own sake. We must learn to distinguish between the sort of knowledge which can be exhibited by sensible images and "the greatest and noblest truths" which "have no outward images of themselves visible to man, . . . and therefore we ought to practice ourselves in the idea of them; for immaterial things, which are the highest and greatest, are shown only in thought and idea, and in no other way, and all that we are saying is for the sake of them."[53] Dialectics, he thinks, makes us "more capable of expressing the truth of things."[54] It helps us to think clearly. Dialectical thinking means being fully awake as to the ideas implied. The non-reflective are like sleep-walkers. "Every man seems to know all things in a dreamy sort of way, and then again to wake up and to know nothing."[55] To bring people to consciousness of the ideas we must proceed by means of examples. "The higher ideas, my dear friends, can hardly be set forth except through examples." In all this we are reminded of the sixth book of the *Republic.* For the explicit statement of the different grades of knowledge, we have to refer to the end of the sixth book of

the *Republic*. The treatment of knowledge and "the higher ideas" in the *Statesman* is crude beside that of the *Republic;* and it should be noted that in the *Statesman,* Plato has not integrated the ideal of the statesman with that of the philosopher. Plato is content to say that the statesman should have a "science of government".

Most, if not all, of Plato's cosmological ideas are indicated in the *Statesman*. Plato here suggests the conception of cosmic cycles—a conception which was to play an important rôle in Stoicism. Though the Stranger speaks of "infinite cycles of years", he gives an account of only three cycles: first the golden age of Cronos, then the cycle when God let go, and, finally, the cycle of Zeus in which we live. "There is a time when God goes round with the world which he himself guides and helps to roll; and there is a time, on the completion of a certain cycle, when he lets go, and the world being a living creature, and having originally received intelligence from its author and creator, turns about and revolves in an opposite direction."[56] But we must not suppose that there are "two gods which having intelligence oppose one another in the movement of the world."[57] The dualism of the *Statesman* is like that of the *Timaeus,* not like that of the *Laws* where Plato postulates an evil soul or souls to account for the opposite movements in nature. In the *Statesman* he tells us that "necessity and innate desire reversed the motion of the world",[58] when God let go the helm. Primitive matter or blind necessity is opposed to the Creator as in the *Timaeus*. Even heaven and the universe, although they have been endowed by the Creator with many glories, partake of a bodily nature, and therefore cannot be entirely free from perturbations. "But the heavenly motion is, as far as possible, single and in the same place; and is therefore only subject to a reversal which is the least alteration possible."[59] In our period of change, the wildness of chaos is more powerful and with difficulty subdued even at best.

The myth of creation in the *Statesman* exhibits the relation of the Creator to the world by showing what would happen to the world if the Creator withdrew, after having created the

world, while in the *Timaeus* the contrast is between the primitive chaos and the world as created. There would be first of all the great reversal, when time would be reversed and history would unroll itself backward. But after the great cataclysm, which this reversal would cause, "the universal creature" would settle down to its accustomed course by virtue of the original endowment. However, there would be a decrease in exactness and a continuous degradation. "The reason of the falling off was the admixture of matter in the world; this was inherent in the primal nature, which was full of disorders, until attaining to the present cosmos or order."[60] The disorder would continually increase with the process of separation from God; the evil, which was small under the dominance of God in the golden age, would become more prominent; there would be more and more forgetting and "at last small was the good, and great was the admixture of the elements of evil, and there was danger of universal ruin of the world and the things in the world."[61]

Then God takes pity upon the world and a new cycle begins. "Wherefore God, the orderer of all, seeing that the world was in great straits, fearing that all might be dissolved in the storm, and go to the place of chaos and infinity, again seated himself at the helm; and reversing the elements which had fallen into dissolution and disorder when left to themselves in the previous cycle, he set them in order and restored them, and made the world imperishable and immortal."[62] But while in this new order—the cycle of Zeus in which we live—God gave, through his ministers, the gifts necessary for man's existence—fire by Prometheus, the arts by Hephaestus and Athena, seeds and plants by others—, men now "had to order their course of life for themselves and were their own masters, just like the universal creature (the world soul) whom they imitate and follow."[63] Plato thus pictures three possible relations of God to creation—(1) a detailed personal providence, "in those days when God himself was their shepherd, and ruled over man, just as man, who is by comparison a divine being, still rules over animals"[64]—the garden of Eden cycle—; (2) the condition when God, after creating the world, let it go; and (3) the rela-

tion of general providence in which man must learn by his own creativeness and suffering the ways of God. The last stage is not mythical but the stage in which we live.

It would be interesting to speculate about the relation of the *Statesman* to the *Timaeus*. The essential dualism of God and chaos is the same. In the *Statesman* as in the *Timaeus*, Plato speaks of "the alphabet of things". Like children learning their letters, the soul learns to distinguish the same letters in unfamiliar combinations, "having somehow or other a correct notion of certain combinations: but when they are translated into the long and difficult language of facts, is again ignorant of them."[65] Here we deal with probabilities. In the association of chaos with infinity and the emphasis on the greater and less and the mean, we have a suggestion of the *Philebus*;[66] and in the interest in discourse[67] we may have a prophecy of the *Phaedrus*. But all we can be sure of is the close interlacing of Plato's constructive dialogues and of the cosmological interest running through them like a silver thread.

Plato's Cosmology Complete

The *Timaeus* is Plato's great cosmological drama. It is evident now that Plato's cosmology has been a long time preparing. Plato recognized in the *Phaedo* that the cosmological explanation is the only real explanation. He had then examined the efforts of others and tried his own hand at the task. He was not yet ready to propose a cosmology. But his mind continued to work at the problem, as is shown by hints in the *Symposium,* the *Theaetetus,* the *Gorgias,* the *Republic* and the *Sophist.* And the problem was in his mind to the end of his labours, as shown in the *Philebus* and the *Laws.* But the *Timaeus* is his supreme attempt to formulate a solution. The dialogue itself was long in the making, and spans a great part of Plato's creative career. In the introduction to the *Timaeus* he places it the next day after the *Republic.* He gives a summary of the *Republic,* without, however, making any reference to the characteristic part of the sixth and seventh books. On the other hand, the conception of God in the *Timaeus* is very much in the spirit of the second and tenth books of the *Republic.* Plato may have begun the *Timaeus* before he finished the *Republic* as it now stands.* But whatever may be the relation of part of the dialogue to the *Republic,* it is certain that the dialogue as it stands represents a considerable period of time. The *Timaeus* is a dialogue with a major interpolation, and probably several minor interpolations.

* I cannot agree with my friend, the great Plato scholar, Paul Shorey, that the parts of the *Republic,* summarized at the beginning of the *Timaeus*—"the division of labor and of classes, the special education of the military, their simple communistic life, and the peculiar and memorable provisions for marriage and the generation of children"—"are the chief points relevant to Plato's present purpose", which appears to be to construct a cosmology! It would seem that the conception of forms and especially the conception of the good as the creator of essences and the final rationale of existence, in the sixth and seventh books—not to speak of God as the creator of all forms in the tenth book—would be much more relevant to the main theme of the *Timaeus.* At any rate it appears so to a mere philosopher like myself. Shorey's great work *What Plato Said* (University of Chicago Press, 1933) from which I have quoted, p. 330, came out unfortunately after this chapter was written. I am pleased to have my feeling confirmed of the Democritean background of Plato. I may add that Shorey has no small responsibility for this chapter being written. He counselled me some years ago not to imitate the scholars in the field but to follow my own intuition.

Owing to the interpolation, it falls into three main parts. After a considerable cosmology, Plato interrupts the discussion to begin again with a new and original analysis of the problem.[68] He later resumes[69] where he left off, giving a brief résumé of the argument. He reminds himself to be concise lest "we interpolate in our present long discourse a digression as long".[70]

The conception of creation in the main dialogue is dualistic. It is a contrast between the world of being, which eternally is and which is apprehended by reason only, and the world of process which is grasped by opinion with the help of sensation and which is always in a state of "becoming and perishing, but never really is".[71] The world is created and has a beginning, "being visible and tangible and having a body, and therefore sensible; and all sensible things which are apprehended by opinion and sense are in a process of creation and created". We have the evidence clearly before us in experience. Whatever comes into being runs through its cycle and passes away. "What is created," i.e., has form, "must be created by a cause." While this seems a co-ercive inference for Plato, he recognizes that we cannot deduce the nature of this cause and its operation *a priori* by an examination of ideas. "But how can we find out the father and maker of all this universe? Or when we have found him how shall we be able to speak of him to all men?"[72] The only proof of the existence and nature of God must be functional. It must be a creative induction from experience in the light of our guiding ideal, the good. Plato does not confuse intuition with proof. Inductive proof must be a tentative process. It is a question of probability, not of absolute demonstration, though we must test our ideas to the best of our ability. The speaker is apologetic: "If then, Socrates, amid the many opinions about the gods and the generation of the universe, we are not able to give notions that are in every way exact and consistent with one another, do not wonder at that. If only we adduce probabilities as likely as any others, that ought to be enough for us, when we remember that I who am the speaker, and you who are the judges are only mortal men, and we ought to accept the tale which is probable and not enquire further."[73] The

dialogue shows that Plato has made a thorough study of the naturalists in preparation for his own interpretation. One must admire the solicitude of Plato in the *Timaeus* to do justice to the naturalistic explanation. Science may not be the whole truth nor the ultimate truth about nature, but philosophy cannot afford to ignore the data of science.* It should be noted that the circle in the *Timaeus* are familiar with the teleological approach and sympathetic with the magnificent experiment of creating a teleological cosmology.

Plato starts with the world as he finds it in human experience. This world is a mixture of being and non-being. We can see meaning and value in it—in human life and in nature. But a great deal of it is weather. How shall we explain such a world? We must conceive the order and meaning in it as due to a creative artist. "Finding the whole visible sphere not at rest, but moving in an irregular and disorderly manner, out of disorder he brought order, considering that this was far better than the other."[74] The order of the world is due to divine genius. "The creator was good, and no goodness can have any jealousy of anything. And being free from jealousy, he desired that all things should be as like himself as possible."[75] God did not create the world according to the idea of the good, but like himself. God is the fairest and best. Being "the best of intelligible and everlasting beings,"[76] the creator framed the world "with a view to that which is apprehended by reason and mind and is unchangeable".[77] This is what Plato means by the Creator looking to the eternal.

When Plato speaks of the creator looking "to that which is eternal",[78] he does not mean that God looked to a pre-existent model, for he tells us expressly that God created the model, and "the pattern of the universe contains in itself all intelligible beings, just as this world contains us and all other visible creatures."[79] Plato could not have meant that there is a realm of forms, existing in abstract isolation independently of God, for

* In the *Republic*, too, in the seventh book, 533, Plato lays it down that dialectic can be revealatory "only to one who is a disciple of the previous sciences".

he tells us in emphatic language in the *Sophist* (249) that it is absurd to suppose "that motion and life and soul and mind are not present with absolute being. Can we imagine being to be devoid of life and mind, and to remain in awful unmeaningness an everlasting fixture?"[80] Perfect being must have life and mind and these must be included in soul. We thus have creative personality as the ultimate conception of being. If forms are conceived as functions of creative intelligence, we can see how forms have the characteristic of power, which according to the *Sophist* (247, 248) is an essential qualification of being. As predicative functions in discourse essences can have intercommunion with one another, while "those who distribute being into immutable and everlasting kinds" (251) can only affirm an essence of itself, saying that man is man and good is good, and so make thought and discourse impossible. It is creative intelligence which can cause things to exist which did not previously exist and God is the Supreme Creator (265). We learn in the *Statesman* (294) that the ideal ruler, like Providence, makes his own laws and in the *Parmenides* (132) that the hypothesis of self-existent and separate forms leads to all kinds of absurdities. Is it likely then that Plato thought of the Creator as looking to a world of eternally pre-existent separate forms? That Plato regards the forms as created is suggested in the sixth book of the *Republic* where we are told that the forms are created by the good: "The good may be said to be not only the author of knowledge to all things known, but of their being and essence, and yet the good is not essence, but far exceeds essence in dignity and power."[81] And in the tenth book of the *Republic* we are told expressly that God is the original creator of all forms (596, 597).

In the *Timaeus,* God did not make the world like a pre-existent world of forms but like himself. Just as in understanding the world our creative intelligence must grasp the form or structure, so in creating the world creative intelligence first expressed itself in forms. The sensuous expression is later and secondary. That is always true in creativeness, whether in art or science. The literally minded, who interpret Plato's dramatic statement of "looking to the eternal" as meaning that the forms eternally

pre-existed should also take literally his dramatic statement that the Creator, reflecting upon the visible worlds—one whole put against another—had sensibly before him the different types of visible world for examination and "found that no unintelligent creature taken as a whole was fairer than the intelligent taken as a whole."[82] Obviously it means that God created in his thought the possible visible worlds and made his choice before objectively creating the world by putting measure and number into chaos. So God's intelligence created the system of forms before he imaged them in a sensuous world. The word, eternal, does not for Plato mean everlasting but precisely the intelligible—that which is grasped by reason because the creation of reason. The forms of things, therefore, are eternal even if they were created with the creation of the world. The forms are timeless for Plato.

Having created the model,* God created the cosmos out of the primitive four elements—earth, water, air and fire. He created the soul first because the soul is prior to the body in dignity and power. In the *Timaeus,* Plato departs from the idea of the soul in the *Phaedo* as simple and, therefore, indivisible. In the *Timaeus* the soul is compounded from the same and the other with an essence of its own. The soul is conceived as a ratio. But to avoid the argument in the *Phaedo,* that the composite is destructible, Plato in the *Timaeus* tells us that the ratio of the soul can be destroyed only by the creator. He created the world the fairest possible which means that it must be intelligent. And since "intelligence could not exist in anything which was devoid of soul", "he put intelligence in soul and soul in body." He made the world in the form of a globe, that being the fairest of figures. He made it self-sufficient and put the soul in the centre and suffused it through the whole, "and he made one solitary and only heaven, a circle moving in a circle, having such excellence as to be able to hold converse with itself, and needing no other friendship or acquaintance. Having these purposes in view he created the world to be a blessed god."[83]

* "Like a good ruler, Plato's God frames a model constitution to guide his creative efforts. The influence of Plato's political thought on his cosmology is apparent here." Norman Hinton.

The structure of the world, like its creator, is eternal. But the world itself, being a world of process, could not be eternal. God therefore made "a moving image of eternity," by creating the rhythm and periodicities of the heavenly bodies according to number. "For there were no days and nights and months and years before the heaven was created, but when he created the heaven he created them also."[84] There is no inconsistency in Plato's speaking of a disorderly motion before time was created, for time means rhythmic motion, and this was created with the heaven.

Having created the cosmos with the heavenly bodies and also having created the junior gods, he entrusted the details of creating man and other living creatures to these junior gods. God, as Howison put it, is a creator of creators. "The divine and immortal part of them, which is the guiding principle of those who are willing to follow justice and the gods—of that divine part I will myself give you the seed and the beginning."[85] The divine artist contributes the pattern, the mind and soul of the individual. In a less mythical way, Plato speaks of the details as being "the work of the second and cooperative causes which God uses as his ministers when executing the idea of the best as far as possible."[86] These secondary causes "are thought by most men not to be the second, but the prime causes of all things, which they cool and heat, and contract and dilate and the like". But we should "explore causes of intelligent nature first of all. . . . Both kinds of causes should be considered by us, but a separation should be made of those endowed with mind and which are the workers of things fair and good, and those which are deprived of intelligence and accomplish their several works by chance and without order".[87] Plato gives a place to the naturalistic type of explanation, but cautions against the use of that as the final explanation. To understand things truly, we must understand them in terms of value, and this for Plato has cosmic significance. We may explain naturalistically the power of the eyes which they now possess, and the reflection and refraction of images, but we cannot thus explain their purpose: "God invented and gave us sight to this end—that we

might behold the courses of intelligence in the heaven, and apply them to the courses of our own intelligence which are akin to them, the unperturbed to the perturbed; and that we, learning them and being partakers of the true computations of nature, might imitate the absolutely unerring courses of God and regulate our own vagaries."[88] The same may be affirmed of speech and hearing; they have been given by the gods for the same ends and purposes. The naturalistic point of view has a place, though it misses the main point—that of creative intelligence in the universe. For it is by the kinship of our mind to the creative mind in the universe that we can understand the ultimate significance of things, if at all.

As time went on, Plato felt that he had not done justice to the material conditions of creation—the world of necessity. In the world in which we live, necessity has been persuaded "to bring the greater part of created things to perfection".[89] But unless we understand the material with which the divine artist must work, we cannot understand why the world is what it is. In the new analysis which Plato interpolates, he leaves behind the science of Empedocles and the early naturalists. He has discovered the atomists who furnish a more adequate picture of the world of necessity, which Plato also calls the world of chance or accident because it is not guided by teleological causes. In the first discussion Plato dealt with two factors: "One which was assumed by us to be a pattern, intelligible and always the same; and there was a second, which was only the imitation of the pattern, generated and visible."[90] Now he feels that this analysis is inadequate. He must add a third factor. This he naturally finds it difficult to explain, because it has no intelligible nature. (The reader will share Plato's difficulty.) But we may attribute "a natural power" to it. We may call it "the receptacle, and in a manner the nurse of generation".

There are three factors in creation: structure, becoming, and space. When we think about the world we think in terms of structure. The structure of nature has been contributed by the divine mind and it is this structure which makes the world intelligible to mind. But if we abstract structure from the chang-

ing world of becoming we can, Plato thinks, still apprehend it by sense and opinion. The third factor, space, cannot be an object of thought; for it has no structure, nor can it be sensed. We grasp it by "a spurious reason,"[91] a sort of intuition. But still Plato is able to tell us what we mean by it. It "is eternal and admits not of destruction". It is what we mean when we say "that all existence must of necessity occupy a space and that what is neither in heaven nor in earth has no existence".[92] Surely such a space would be a dry nurse of creation.

We get a clearer idea when Plato tells us that "being, space and becoming, in their three manners, existed before the world".[93] Being or structure, which God contributes, must be contrasted with becoming and space, i.e., with space and its disorderly contents. The latter two constitute the nurse or matrix in which creation takes place. In this motley matrix everything is confused and interfused. The mixture shows traces of earth, water, air and fire. It is moistened, fiery, earthy and watery. These mixed contents are in a perpetual state of commotion on account of their lack of equilibrium, but through being shaken to and fro they are separated "like the grain shaken and winnowed by fans and other instruments used in the threshing of corn, when the close and heavy particles are borne away and settle in one direction, and the loose and light in another".[94] As a result of this winnowing process, the unlike elements are separated off and the like elements are brought together. This sorting of the elements into different places takes place before the creation of the world. The whole illustration of the winnowing machine and its work is borrowed from Democritus. This would be as easily recognized by Plato's contemporaries as would be the borrowing from Empedocles and other scientists. It is absurd to suppose that the elements were constituted by triangulating space, because the elements in a vague way were already in existence, and the mechanical sorting process had taken place, "before the universe that was arranged out of them came into being". What God contributed was "form and number". He gave mathematical form to matter which heretofore lacked structure. Plato adopted the conception of

Leucippus and Democritus as the picture of the world of necessity—the world without God. By a stroke of genius Plato made use of the world of Democritus as a limiting concept, as Einstein used the space of Newton.

In the introduction to the interpolation, where Plato promises an account of "the nature of fire and water, and earth and air which were prior to the generation of the heavens and what happened before them," he tells us that the previous account in terms of the four elements must be regarded as a rough approximation. So far from these elements being "the letters or elements of the whole" (the analogy of letters is probably borrowed from Democritus), they cannot be regarded as even "the syllables or first compounds".[95] He will not here essay the difficult task of speaking "of the first principle or principles of all things". He will approach the problem inductively and observe the rule of probability to the best of his ability. He gives as a reason for distrusting the simplicity of the four elements that they are in a perpetual state of transformation, and never appear in the same form. But this does not apply to the ultimate elements. The transformation applies macroscopically,* not microscopically.

He starts with the assumption that "fire and earth and water and air are bodies" and that bodies are solids. This is in marked contrast with a statement in the earlier part of the dialogue, viz., that "nothing is visible when there is no fire, or tangible, which is not solid, and nothing is solid without earth".[96] In this contrast he sets earth, the solid element, over against fire. The other elements are intermediate. The later conception of matter, as consisting ultimately of solids or plena, is of course derived from Leucippus, who adapted to his needs the being of Parmenides. The solids again "must be contained in planes, and the plane rectilinear figure is composed of triangles; and all triangles are originally of two kinds, both of which are made up of one right and two acute angles; and one of them has at either end of the base the half of a right angle which is divided

* Strictly, only the three elements, water, air, and fire, are transformable into one another. *Timaeus*, 54.

by equal sides, while, in the other, unequal parts of a right angle are divided by unequal sides".[97] Of the latter kind there are an indefinite number, but he chooses the one "having a longer side, the square of which is three times as great as the square of the lesser side". Why Plato uses plane geometry to describe solids is difficult to see. Possibly this is in deference to Timaeus, a fifth-century Pythagorean, who did not know solid geometry. In any case, Plato leaves no doubt that the ultimate elements are solids, and that he is substituting surface figures for purposes of description.

There are then two kinds of shapes of the ultimate elements, but there are "as many sizes as there are differences of species". This is a refinement on the atomists who included size in shape and had an indefinite number of shapes—all invisible as with Plato. Without God there would have been the variety of chance as in Democritus' theory. The four elements, Plato thinks, can be regarded as combinations of these two ultimate shapes, and Plato gives an account of how the gross elements are constituted from them. Earth is constituted by the solids which are bounded by the isosceles right angled triangle, the other three elements are made of the other kind of shape.

Plato's hypothesis of the shapes of the elements and the shapes of their combinations—the molecules of the elements—is dictated by two considerations, that of beauty and that of suitableness to account for the facts. An hypothesis, in other words, must be aesthetically congenial, but it must also work. And Plato feels that his hypothesis has these two merits, but it is tentative and he offers a reward for a better hypothesis. The fact which is critical for Plato is that of mobility. The earth atom must have a cubical form for it is the most immobile and the fire atom has a pyramidal shape because it is the most prickly and penetrating in character. It is also the lightest as it has the fewest bases, and the earth atom is the heaviest because it has the most bases, i.e., has most matter. Thus weight, as with Democritus, depends on size. Earth can be dissolved and recombined but cannot be transformed into any other element. The other three elements can be dissolved and transformed into one an-

other. This process requires great force. "Among bodies which are similar and uniform, none can change or be changed by another of the same class and in the same state."[98] This idea was later adopted by Aristotle. Plato thus first gives a naturalistic statement of the nature of matter and its distribution before creation, i.e., abstracted from God. He then shows what God contributed to the vague amorphous world of mechanical distribution, viz. measure and number. "The ratios of their numbers, motions and other properties everywhere, the God, as far as necessity consented and allowed, has exactly perfected, and harmonized them all in due proportion."[99]

With this reminder, Plato goes on to give a naturalistic account of motion. In the continuous mixing process various compounds assimilate or reject according to their nature. The sorting milieu thus distributes the elements into their natural places, as we have already seen. But why does not motion come to an end, when things are sorted into their natural places? Plato, with the naturalists from Anaximander down, believed in an eternal motion of matter. But he tries to explain this perpetual motion. Motion implies inequality or lack of equipoise; this is what gives rise to the relation of mover and moved in nature. These are relative to one another in the mechanical world. But why does not this lack of equipoise come to an end in a natural distribution of the elements? Plato was near to discovering the law of entropy. He saw that there must be what we call an unequal distribution of potentials for motion to exist. But he tried to find a way to show that motion would always go on. In the revolution of matter there is a compression of the parts and a tendency to close up the void within matter. "The tendency toward condensation thrusts the smaller particles into the interstices of the larger,"[100] according to their penetrating power. The particles of the different elements are thus borne up and down and every way, shooting through the interstices of one another. Thus the variation in shape and size causes a variation in place. "These causes generate an inequality which is always maintained, and is continually creating a perpetual motion of the elements in all time."[101] But one wonders why the con-

densation does not reach an equilibrium, with all the interstices filled. It would seem as though a one-way process must reach an end.

The pictures of interstices in things—varying with the size of the constituent particles—and of the interpenetration of matter is unmistakably that of the atomists. The revolution itself antecedes creation and seems to be the whirl of Democritus. The conception of the void as conditioning motion is in striking contrast with that of the older dialogue where Plato, following Empedocles, assumes an absolute plenum and where motion is only possible by displacement, one thing pushing its neighbour out of place and that again pushing its neighbour out of place, "because there is no such thing as a vacuum".[102]

There are, then, according to the *Timaeus* two kinds of causes —mechanical causes and teleological causes. The latter are superinduced upon the former, and give meaning and value to the world. There are consequently two methods of research. There is the naturalistic method which starts with perception and proceeds by hypothesis and induction to explain the world as it appears. It deals with the world as it is before creation or as it would be without God. In other words, it takes no account of teleology. And there is the method of creative thought which tries to comprehend the universe in terms of structure, ideas, first principles. The latter method seeks the intelligible which is only fragmentarily revealed in the medium of the world of process, but which gives meaning and value to the world of process. It shows what the principles of nature are when there are no interfering causes. Thus the planets would naturally move in circles, but because of interfering causes their orbits have all sorts of irregularities. When we grasp the limit—the perfect circle, the perfect beauty, the perfect goodness—we see the real meaning of the world and can the better understand the deviations. The intelligible in turn is the expression of intelligence, i.e., of the genius of God. Our mind can comprehend nature because it is akin to the mind which gives order and meaning to things.

The creation for Plato has a beginning, though motion has

no beginning. The idea of a beginning was suggested by Anaxagoras. According to the *Phaedrus* the soul starts the motion in the beginning. He assumes creation in the beginning in the *Philebus* and in the *Laws*. It is therefore characteristic of the thought of Plato and not peculiar to the *Timaeus*. Aristotle criticizes Plato for holding that the world has a beginning and advances the theory that the world, including the earth and man, is eternal. Xenocrates, the third head of the Academy, says that Plato's language is dramatic in the *Timaeus*, and that he meant that the world is eternal. But what about his language elsewhere? The fact is that the Academy appropriated Aristotle's interpretation, and said that he had gotten it from Plato. But Plato's language is really in line with modern science. The second law of thermodynamics makes it necessary to postulate a finite beginning of our world. It is congenial to the scientific mind to think of the universe as eternal. But in that case there must be a compensatory process, and this science has not discovered as yet, though Millikan thinks that the cosmic rays may be evidence of the synthesis of matter from radiant energy. It is certain that the earth and its inhabitants are not eternal (as Aristotle assumes). Every cycle has a beginning and an end.

In the *Philebus*, Socrates explicitly identifies the good (not the idea), in a cosmic sense, with God. He has shown that neither pleasure without wisdom and mind, nor the opposite can be regarded as the good. He turns to his interlocutor and says: "And now I think I have sufficiently shown that Philebus' goddess (i.e., pleasure) is not to be regarded as identical with the good." Philebus answers: "Neither is your mind the good, Socrates, for that will be open to the same objections." Then Socrates makes the important statement: "Perhaps, Philebus, that may be true of my 'mind,' but not, I think, of the true, which is also the divine mind—that is another story."[103] This "story" probably refers to the *Timaeus*.* At the same time this statement in the *Philebus* helps us to interpret the *Timaeus*.

In the *Philebus*, Socrates attempts the analysis of "the actual

* In the *Timaeus God* is the fairest and best—mind in soul.

nature of the good" which he had excused himself from giving in the *Republic*. While his body has been mouldering in the grave, his spirit has been maturing. He not merely attempts an analysis of the factors which enter into the good, but he attempts a ranking of these factors. A logical analysis of the good must show what is implied in the structure of the good. But the language of structure—such as measure, unity, proportion, symmetry—is aesthetic language. He therefore finds that "the power of the good has retired into the region of the beautiful," for "measure and symmetry are everywhere reckoned as beauty and virtue". The true is also implied in the good, since the pursuit of the good is the pursuit of reality. He finally decides that he must hunt the good with three ideas—"Beauty, Symmetry, Truth". This does not seem clear, since he has already recognized that Symmetry is an aesthetic category. What is clear, however, is that Plato means to make the good the inclusive value. The good must therefore include values of truth and values of beauty, as well as values of virtue. Plato's intuition that beauty, truth and virtue are one in structure was on the right track. It is functionally that they are different.* Socrates recognizes that structural analysis of the good is not sufficient. The good implies mind and wisdom. Else it is an abstraction. It also implies feeling. A good which is not felt is not a good. Knowledge and feeling are elements in the good. Of the two, knowledge, having structure, seems more revealing of the ultimate good than feeling. It is significant, however, that Socrates, even in the *Philebus*, recognizes that hedonic value cannot be ruled out from the good. In the *Laws*, Plato returns to the functional or utilitarian conception of the good. And we have seen that even in the *Republic* he regards this as "the best of sayings". Plato's difficulty, I think, is in projecting his analysis of the good on one plane, either the structural plane or the functional plane. His great merit is that he emphasizes on the whole the functional plane and sees that even the ultimate good cannot be an impersonal abstraction but implies life and mind.

* See the author's analysis in *A Realistic Universe*, ch. XVI, the Identity of the Ideals.

When Plato wrote the *Philebus,* his cosmology had become definite conviction. It is no longer the tentative hypothesis of the *Timaeus.* In the *Philebus* as in the *Sophist,* Plato is conscious of the materialistic naturalists as the real opponents to his idealism. But we see a marked change in the attitude of the audience. In the *Sophist* the interlocutor, Plato's chorus, is young and uncertain but deferential. In the *Timaeus* the chorus is sympathetic but experimental in its attitude. In the *Philebus* the chorus is dogmatic. Socrates says: "Let us begin by asking whether all this which they call the universe is left to the guidance of an irrational and random chance, or, on the contrary as our fathers have declared, ordered and governed by a marvellous intelligence and wisdom". To which the chorus replies: "Wide asunder are the two assertions, illustrious Socrates, for that which you are now saying is blasphemy; but the other assertion, that mind orders all things, is worthy of the aspect of the world, and of the sun, and of the moon, and of the whole circle of the heavens; and never will I say or think otherwise."[104] The tone of the reply is nearer the *Laws* than it is to the modest tentative statement of the *Timaeus.* It is probable that the *Timaeus* is earlier and can be referred to by Socrates as a "story" that is familiar.

Plato's cosmological conception in the *Philebus* is nearer to the *Laws* than to the *Timaeus.* Instead of starting with creation, the *Philebus,* like the *Laws,* starts with the conception of the cosmic organism. The elements in the cosmos are supposed to be like the elements in our bodies. But in the cosmos the elements are infinitely purer and exist on a vastly larger scale. Just as the elements are gathered up in our body, so the elements in the cosmos must be conceived as gathered up in a cosmic body by which our body is wholly nourished and from which it derives its qualities. And whence comes the soul of our body, "unless the body of the universe, which contains elements similar and fairer far, had also soul? Can there be any other source?" The chorus answers: "Clearly, Socrates, that is the only source"—showing that the conception is familiar. Socrates then draws the analogy between the microcosm and macrocosm

with an assurance that is far removed from the *Timaeus*: "Why yes, Protarchus, for surely we cannot imagine that of the four elements, the finite, the infinite, the composition of the two, and the cause or fourth element, which enters into all things, giving to our bodies souls, and the art of self-management, and of healing disease, and operating in other ways to heal and organize,—that this last, I say, should be called by all the names of wisdom, and not imagine that while the other elements equally exist in a larger form, both in the entire heaven, and in the great provinces of the heaven, only fairer and purer, in this higher sphere the cause which is the noblest and fairest of all natures has still no existence?" "That would be utterly irrational," answers the chorus. "But if that is not true," continues Socrates, "should we not be wiser in assenting to that other argument, which says, as we have often repeated, that there is in the universe a mighty infinite and an adequate limit, as well as a cause of no mean power, which orders and arranges years and seasons and months, and may be justly called wisdom and mind?" The chorus answers: "Most justly". Socrates then repeats Plato's conviction, as old as the *Phaedrus,* that "wisdom and mind cannot exist without soul". The cosmological attitude, here expressed, is represented as familiar to the Platonic circle. It shows the reverence for tradition by an old man. Plato feels added assurance from the fact that his theory "is in harmony with the testimony of those who said of old time that mind rules the universe".[105] Plato harks back to Anaxagoras. It should be noted that the conception of elements has become more complex in the *Philebus,* showing a growing Pythagorean influence and pointing to a later period than the *Timaeus.*

In the *Laws* the contrast with the attitude in the *Timaeus* is still more striking. We may be sure that such a change was not produced over-night. The anxiety in the *Timaeus* to do justice to the naturalists has given place to wholesale condemnation. Not only is it preposterous to attempt to explain the world by "nature and chance" and "certain affinities of hot with cold, or of dry with moist, or of soft with hard,"[106] but it is criminal. The materialistic naturalists are "lost and perverted

natures" which must be "persuaded", if possible, of the evil of their ways. And if persuasion in prison fails, they must be put to death as enemies of the State. We must remember, however, that impiety is regarded by law and custom to be a capital crime. Plato no doubt felt he was humanizing the existent law, by allowing a period for conversion and recantation—a procedure followed by the Inquisition later on.

The teleological view of the universe is no longer regarded as a tentative hypothesis, but as demonstrable, though the conviction of the Platonic circle (including Aristotle) is so strong that they require no argument. Proofs of the existence of God are required only to bring to their senses benighted naturalists. The *consensus gentium* and the teleological argument both prove the existence of God, but the latter is stressed. As in the *Republic* and *Sophist,* Plato thinks of nature as divine art. Art is therefore prior to nature as the existent world. It is prior to the elements—earth, water, air and fire. But Plato is no longer interested in Physics, and gives no hint why he regards the elements as works of art. To the man of eighty, the motto is: "Safety first." The safety of the state comes before research.

In the *Timaeus,* Plato recognized, in common with the early naturalists, an eternal, non-teleological motion in nature which the creator reduces to form and number so far as he is able. In the *Laws* Plato goes back to the *Phaedrus,* where soul is conceived as the only self-moving principle and the source of all motion. Secondary motions depend upon the primary motion. There must therefore, according to the *Laws,* be a soul circumfused through the cosmos and "there would be impiety in asserting that any but the most perfect soul or souls carries round the heavens."[107] There are three possible ways in which the soul can order all things: "Either the soul, which moves the sun this way and that, resides within the circular and visible body, just as the soul in us carries us about every way; or the soul provides herself with an external body of fire or air, as some affirm, and violently propels body by body; or thirdly, being incorporeal, she has some extraordinary and wonderful guiding power."[108] Whatever be the method, it is asserted as

"the most perfect and absolute truth . . . that the soul is prior to the body and that the body is second and comes afterwards, and is born to obey the soul which is the ruler."[109] No attempt is made in the *Laws* to distinguish between God in the singular and the cosmic soul. In the *Timaeus* the cosmic soul is itself created by God; in the *Laws*, as in the *Phaedrus*, it is eternal. There are also souls which are causes of the motion and excellence of the stars and of the moon and months and seasons. These are divine and "all things are full of gods." In his constant use of gods in the plural, Plato shows conformity to popular orthodoxy.

Since soul is conceived as the originator of all motion, it becomes necessary to assume an evil soul or souls to account for the origin of evil. In the *Timaeus*, Plato assumes a disorderly motion as existing prior to creation. It is the characteristic motion in nature without God. Nature without God has no form or soul. It is neither good, nor evil, though the inertia of the world of necessity sets certain limits to the ordering activity of God. For the most part it is induced to realize the divine pattern. There are no inherently evil souls in the *Timaeus*. Disease and ignorance are the causes of men doing evil. All that human souls require in order to become good is right education. In the *Laws*,* Plato has become more pessimistic. Evil is not just maladjustment but is inherent in reality. Since all motion is assumed to be due to souls, it follows that just as we must assume a good soul to account for the beauty and goodness which we find in the world, so we must assume an evil soul or souls to account for the disorder and evil in the world: "When the world moves wildly and irregularly, then an evil soul guides it."[110] Plato, however, retains his faith in astronomy. "The whole path of heaven and the movement of all that is therein is by nature akin to the movement and revolution and calculation of mind, and proceeds by kindred laws," and therefore it is plain "that the best soul takes care of the world and guides it along the good path."[111]

* Cp. also *Theaetetus*, 176: "Evils, Theodorus can never perish; for there must always be something which is antagonistic to good."

The *Laws* offer us no light as to how Plato conceives the evil soul or souls. But it is clear that the evil soul is not merely a human soul, though "upon this earth there dwell souls who have an unjust spirit." The conflict of good and evil is a cosmic conflict. "As we acknowledge the heaven to be full of many goods and also of evils, and of more evils than goods, there is, as we affirm, an immortal conflict going on among us, which requires marvellous watchfulness; and in that conflict the gods and demigods are our allies, and we their property."[112] One wonders, if there are more evils than goods, why the teleological argument should seem so co-ercive. One wonders, too, why there should be this balance on the side of evil, if, as Plato maintains, "the good of the soul was by nature designed to profit men, and the evil to harm them,"[113] and if "injustice and insolence and folly are the destruction of us, and justice and temperance and wisdom are the salvation of us."[114] It would seem that the advantage of survival would be on the side of the good, as it undoubtedly is, though there are many degrees of good.

The creator in the *Timaeus* does a wholesale business, in the *Laws* he does a retail business, if I may use a metaphor from William James. In the *Timaeus* God leaves the details to secondary causes. God creates the astronomical order, but after furnishing the junior gods with the immortal part, he entrusts to them the details of creating man and other living things. Hence God is not to be blamed for defects in the details. At worst you can blame the junior gods or the world of secondary causes. In the *Laws*, God, like a good craftsman, takes care of small matters as well as great matters.[115] No detail escapes him. He does not take "a holiday." In ordering things, God has regard to the whole. "The ruler of the universe has ordered all things with a view to the preservation and perfection of the whole, and each part has an appointed state of action and passion," and "you are created for the whole and not the whole for the sake of you".[116]

But the creator is not independent of his material. He must deal with souls which have an initiative of their own. All the

creator could do was to contrive "a general plan by which a thing of a certain nature found a certain seat and room. But the formation of qualities he left to the wills of individuals. For every one of us is made pretty much what he is by the bent of his desires and the nature of his soul".[117] Really therefore the individual determines his own place, for better or worse. "All that remains to the master of the game is that he should transpose the pieces; sending the better nature to the better place, and the worse into the worse, and so assigning them to their proper portion."[118] We must remember that Plato's world is a world of values, and in the eternal scheme of values the pieces must be rearranged so as to make the best possible whole. God makes the best possible world, though it is far from a perfect world.

The law of compensation operates throughout. "When the soul changes greatly, either for the better or worse, by her own impulse or the strong influence of others, when she has communion with divine virtue and becomes divine, she is carried into another and better place, which is also divine and perfect in holiness; and when she has communion with evil, then she also changes the place of her life."[119] No one escapes the causality of his conduct.[120] "If thou sayest: I am small and will creep into the depths of the earth, or I am high and will fly up to heaven, you are not so small or so high but that you shall pay the fitting penalty, either in the world below or in some more savage place still to which thou shalt be conveyed." Thus, "the gods make all things work together and contribute to the great whole".

In the *Republic* the emphasis is on the ultimate significance of the individual. The rest—the state, the cosmic scheme—is machinery to educate the individual in virtue. In the *Laws,* God thinks more of the perfection of the cosmic scheme than of the parts, just as the physician's first care is with the health of the whole organism. But still the parts largely determine their own place by their own initiative. The gods can only reinforce the good resolutions of individuals. The evil soul is eternally busy to disturb the harmony of things. The conflict between good and evil is immortal, and the pieces must ever be rearranged

in order that there may be some sort of harmony in the whole. Plato has no apocalyptic vision of a grand finale. The forces which operate for good or evil operate eternally. But in the meantime a man may save his soul by striving for the good and becoming more like God; and in this striving the gods assist him. Plato's God, unlike Aristotle's, is not pre-occupied merely with his own perfection. He works creatively to induce and encourage perfection. Nor is God, as with Fichte and Emerson, merely an impersonal constitution which registers the action of the parts. He takes part in the struggle.

I have tried to show that the cosmological point of view is a logical working out of Plato's philosophy. The conception of structure cannot be separated from soul and mind in a teleological conception of reality. God is required as the personal embodiment of the good and as the creative genius of the cosmos. In recognizing that the world, as it is, is a mixture of being and non-being, Plato shows a sound respect for fact. The world of our experience is not a perfect world. There is some good in it. But there is a great deal that is evil or indifferent. Cosmology must explain the world as it is. Plato does not, like Hegel, merely juxtapose reality as a world of meaning to existence in its otherness. Such bifurcation is artificial and unreal. Plato's cosmology is an honest attempt to give a cosmic explanation of human experience. His dualism or pluralism is thoroughgoing. His cosmology reaches its height in the *Timaeus* where he shows that the real root of failure lies in an inherent indifference or laziness on the part of the world in which God works to create order and beauty. Without the creative influence of God, this indifference would produce the situation pictured by the materialistic naturalists. In such a world individual parts persist in motion in a straight line, except as otherwise determined by the fortuitous motion of other parts. Determination is merely mechanical, as we should say. But this is not that sort of world. There is pattern-creative activity in this world. We know pattern-activity in art and in morality. In the larger world, too, structure must be to a certain extent realized, for our mind can discover structure. We discover evidence of types and laws in

nature. Else we could not have logic or science. On the other hand, this pattern-creative activity is not wholly successful. The natural laziness of the material must be overcome. Thus we find degrees of approximation only. The limit—perfect realization—is never reached in the world of process. But without the reality of the limit, there could be no approximation. We understand the degrees by creative apprehension of the limit. Furthermore, we must understand the limit as active; and this we can do only when we understand it as creative personality—mind in soul, i.e., God. In the *Laws,* where Plato personifies evil, instead of conceiving it as "cosmic laziness," he takes a backward step. This, we have seen, Plato was led to do by abandoning the Ionian assumption of the universality of some sort of motion and instead attributing all motion to soul. This makes it necessary to assume evil soul to account for evil activity.

Plato was on the right track when he identified evil with "cosmic laziness" (to use Bertrand Russell's phrase). There is always the problem in cosmic evolution of inducing individuals to adjust themselves to a higher pattern—of bringing the electron into the atomic field, the atom into the molecular field, molecules into the structural field of molar body, inorganic matter into the field of living matter, living matter into a more and more complex hierarchy of fields, man into the field of more adequate social patterns, and social patterns into line with the ultimate cosmic pattern. There is always the laziness of the individual to overcome at any stage. And there is always the danger of reversion. Pluralism and inertia are the basis of maladjustment, but we must not forget that they are the basis of progress. This pluralistic and lazy world is the world in which God creates, "as far as necessity [i.e., inertia] permits".

CITATIONS IN CHAPTER 7

1. *Cosmic Evolution*, J. E. Boodin, Macmillan, 1925.
2. *Apology*, 19, Jowett's translation. I have quoted Jowett's translation except when too obscure.
3. Xenophon's *Memorabilia*, 1, 2, 64.
4. *Republic*, VI, 510.
5. *Timaeus*, 51.
6. *Phaedo*, 74.
7. Fr. 6, Burnet's translation.
8. *Phaedo*, 97.
9. *Ibid.*, 98.
10. *Ibid.*, 99. I am indebted here to Kurt Hildebrandt's translation.
11. *Ibid.*, 99. Italics are mine.
12. *Ibid.*, 100.
13. "Welcher sich unmittelbar an die gegebenen Dinge wendet", Kurt Hildebrandt, *Phaedo*, 100.
14. *Sophist*, 246.
15. *Phaedo*, 100.
16. *Ibid.*, 107.
17. *Symposium*, 211.
18. *Timaeus*, 51.
19. *Greek Philosophy—Thales to Plato*, John Burnet, p. 198.
20. *Phaedrus*, 266.
21. *Ibid.*, 247.
22. *Ibid.*, 250.
23. *Ibid.*, 249.
24. *Symposium*, 212.
25. *Phaedrus*, 249.
26. *Ibid.*, 245.
27. *Phaedrus*, 244 ff.
28. *Symposium*, 202 ff.
29. *Phaedrus*, 245.
30. *Ibid.*, 270.
31. *Ibid.*, 270.
32. *Philebus*, 30.
33. *Phaedrus*, 279.
34. *Ibid.*, 265, 266.
35. *Theaetetus*, 176.
36. *Ibid.*, 176.
37. *Gorgias*, 506.
38. *Ibid.*, 507, 508.
39. *Republic*, 505.
40. *Ibid.*, 506.
41. *Ibid.*, 506.
42. *Ibid.*, 508.
43. *Ibid.*, 511.
44. *Ibid.*, 540.
45. *Ibid.*, 509.
46. *Ibid.*, 598.
47. *Sophist*, 265.
48. *Ibid.*, 265.
49. *Ibid.*, 266.
50. Cp. Bk. X of the *Republic*.
51. *Statesman*, 294.
52. *Ibid.*, 285.
53. *Ibid.*, 285, 286. Cp. *Republic*, 510.
54. *Ibid.*, 287. Cp. *Republic*, 511.
55. *Ibid.*, 277. Cp. *Republic*, 505, 506.
56. *Ibid.*, 269.
57. *Ibid.*, 270.
58. *Ibid.*, 272.
59. *Ibid.*, 269.
60. *Ibid.*, 273.
61. *Ibid.*, 273.
62. *Ibid.*, 273.
63. *Ibid.*, 274.
64. *Ibid.*, 211.
65. *Ibid.*, 278.
66. *Ibid.*, 273.
67. *Ibid.*, 286.
68. *Timaeus*, 48, in Jowett's numbering.
69. *Ibid.*, 69.
70. *Ibid.*, 51.
71. *Ibid.*, 28.
72. *Ibid.*, 28.
73. *Ibid.*, 29.
74. *Ibid.*, 30.
75. *Ibid.*, 29.
76. *Ibid.*, 37.
77. *Ibid.*, 29.
78. *Ibid.*, 29.
79. *Ibid.*, 30.
80. *Sophist*, 249.
81. *Republic*, 598.
82. *Timaeus*, 30.
83. *Ibid.*, 34. This suggests Empedocles' *Sphairos*.
84. *Ibid.*, 37.
85. *Ibid.*, 41.
86. *Ibid.*, 46.
87. *Ibid.*, 46.

88. *Ibid.*, 47.
89. *Ibid.*, 48.
90. *Ibid.*, 48.
91. *Ibid.*, 49.
92. *Ibid.*, 52.
93. *Ibid.*, 52.
94. *Ibid.*, 52. See Otto Apelt's translation.
95. *Ibid.*, 48.
96. *Ibid.*, 31.
97. *Ibid.*, 53.
98. *Ibid.*, 57.
99. *Ibid.*, 56.
100. *Ibid.*, 58.
101. *Ibid.*, 58.
102. *Ibid.*, 79.
103. *Philebus*, 22.
104. *Ibid.*, 28.
105. *Ibid.*, 30.
106. *The Laws*, 889.
107. *Ibid.*, 898.
108. *Ibid.*, 898.
109. *Ibid.*, 896.
110. *Ibid.*, 897.
111. *Ibid.*, 897.
112. *Ibid.*, 906.
113. *Ibid.*, 904.
114. *Ibid.*, 906.
115. *Ibid.*, 901.
116. *Ibid.*, 903.
117. *Ibid.*, 904.
118. *Ibid.*, 903.
119. *Ibid.*, 904.
120. *Ibid.*, 905.

Chapter 8

CREATIVE EMERGENCE AND SUBSTANCE IN ARISTOTLE

While we think of Plato as a creationist, we generally think of Aristotle as a preformationist. It is true that Aristotle assumes the eternity of the world with its structure and is in this general sense a preformationist. But in the world under the moon concrete things emerge with their novel characteristics. On the main issue Plato and Aristotle agree. Both regard God and the forms as eternal. Their approach to the problem is indeed different: Plato regards the forms as creations or expressions of divine genius, while Aristotle conceives them as immanent. But in neither case do the forms emerge from the temporal process. It is the concrete world that emerges in time. Emergence under the guidance of form we call creation. And we shall see that there is genuine emergence in Aristotle's conception of the universe.

Form and Matter

In his controversy against the doctrine of ideas* (as he interprets it), Aristotle sets himself to emphasize the immanence of form. The essence is in the things, not outside things. There are no floating essences. We must take reality as we find it. As it is now, it always has been, and always will be. Aristotle rejects the idea of a dramatic beginning of the universe. The universe is eternal. Motion is eternal. The forms have always existed in things as they do now. There is no super-existential world in which forms subsist. There is advance from the potential to the actual in individual history. But the actual, the mature individual, is prior to the potential, the evolving individual. Acorns come from oaks and therefore develop into oaks.

* By Platonism Aristotle generally refers to the contemporary Academy and its teachings. He sometimes uses the expression, "we Platonists," including himself. When he has reference to Plato himself he generally names him or the dialogue.

There is no origin of species. Everything moves by a nature inherent in itself. "Although there are many propositions about moving things as moving (independently of their other attributes and their general nature), it is not necessary on that account that there should exist a moving somewhat, separate from the things of sense, or that a determinate entity of that kind should be found in them."[1] This seems like a definite repudiation of transcendency of all sorts.

Aristotle was brought up in the atmosphere of Greek naturalism. His father was a physician and came from a lineage of physicians; and the physicians carried on the tradition of naturalism. It is as a biologist that Aristotle is entitled to a place in the hall of fame of science. While Charles Darwin owns his debt to men like Cuvier and Linnaeus, he regards them as children compared to Aristotle. The latter's descriptive work of observation and classification is a stupendous contribution to the biological sciences; and his contribution to genetics is to us of even more immediate significance. Aristotle may be regarded as the founder of the science of embryology. What a pity that Darwin could not have seen the significance of Aristotle's conception of the whole-form or entelechy. It might have saved the morass of mechanistic speculation in our own day. Harvey was in this respect keener than Darwin.

Aristotle's biological interest predisposed him to immanentism. It seems almost a tragedy that Aristotle should not have developed the biological point of view into a cosmology. It would have been a naturalistic pantheism. He does indeed speak of nature as an inclusive animal and of development in nature as proceeding by a principle immanent in nature itself. But another influence came in to prevent his carrying out this biological immanentism into a consistent metaphysics. This was the influence of Plato. Plato's approach was that of the mathematician and artist. While Aristotle, with his biological bias, never could assimilate Plato, yet Plato haunts him. Hence the artificiality of Aristotle's system which fell between his own biological bent to immanence and the transcendental conception of Plato. It was through Plato's influence that Aristotle adopted

the dualism of form and matter. From Plato's mathematical and aesthetic approach to reality it is clear that form is never completely realized in matter. Hence form cannot be metaphysically immanent in matter. In the world of existence there is at best approximation, never immanence.

The dualism is veiled in Aristotle by the fact that he conceives the process as eternal. In an eternal universe, form and matter never exist entirely apart. We never find mere matter. Matter is always more or less formed. But Aristotle does not succeed altogether in escaping the transcendence of Plato. Matter in our world of change is never completely mastered by form. There is ever the not-quite. We have the paradox of an immanence which is not quite immanent. For Aristotle as for Plato, things as they exist under the moon fall short of their proper form. Aristotle's philosophy like that of Plato becomes dominated by the aesthetic and ethical point of view. Fact is judged from the point of view of value. The activity which interests Aristotle as well as Plato is teleological activity. He gives but grudging recognition to mechanical action. But the realm of ends must be realized in the realm of circumstance. And while circumstance furnishes the opportunity for realization, it also sets limitations to realization.

It is in the realm of creative activity that Aristotle, like his master, Plato, sees the greatest cleavage in nature. Be it in science, art or social reconstruction, creative intelligence must transcend the routine of habit and custom. In the lower stages of nature there seems to be automatic repetition or largely so. But in the domain of reason we find it necessary to criticize and to reconstruct. We must look upon things at any stage, short of the final realization, as raw material to be informed by pattern. Thus we create works of art and nobler forms of human society. To account for the transition from the routine of nature to creative intelligence—the most momentous transition in our experience—Aristotle finds it necessary to postulate a contact of the biological soul with a creative reason in the cosmos. But in a large sense nature, too, even though not conscious of the fact, is informed by the reason of the whole, for nature works

like an artist. It strives to realize form in matter; and its love for form, even though unconscious, must be inspired by "contact" with cosmic reason. For Aristotle, as for Plato, nature is a living whole and works to realize ends.

The relation of form to matter leads to Aristotle's doctrine of degrees in nature. There is a graduated and continuous scale from inorganic matter to God. In this way Aristotle tries to reduce the dualism of the Platonic system. Aristotle is impressed with the continuity in nature: "Nature makes so gradual a transition from the inanimate to the animate kingdom that the boundary lines which separate them and the position of the intermediate are rendered indistinct and doubtful. Next to the inanimate kingdom comes that of plants; and there we not only distinguish greater and less degree of vitality subsisting among individuals, but the whole tribe seems animate when compared with inorganic substances, inanimate compared with animals. Again, the transition from plant to animals is so gradual that many marine creatures leave us in doubt whether they are animals or vegetables, since they adhere to the ground and cannot live when separated from it. Indeed the whole tribe of Ostraceae, when compared with locomotive animals, resemble vegetables."[2] This gradation in nature is of such a kind that the higher level presupposes and includes the lower, i.e. the animal level presupposes the vegetable, and the level of the rational soul presupposes the animal and vegetable functions which it dominates in a well-regulated life.

But there is another and still more important aspect to this gradation of levels. The stair-case of gradations is a stair-case of spiritualization. There is a gradual emancipation of spirit. In the lowest existent stage, that of inorganic matter, the dominance of form over matter is vague and uncertain. It is true that the elements, fire, air, earth and water are formed out of indeterminate matter and the pairs of contraries—the wet-dry and the hot-cold—; and so the elements must be said to have form of a sort; it is also true that they seek their natural places in the distribution of elements in nature, but at best the elements in nature below the moon are impure, i.e. mixtures, and in in-

organic nature there is no such striving for a definite individual end as we find in organic nature. In organic nature, the process is guided by an entelechy, a formative pattern. There is a progressive addition of functions in the ascent of nature; the animal level adds sensation and movement to the vegetative functions of nutrition and reproduction; and in man we have the extra-mundane addition of reason. Creative reason becomes incarnate in the biological individual. While the reason in man works through the organic mechanisms of sensation, imagination and memory, it is separable from the body since it is not of the body. In the higher orders of being, the stars and spheres, the changing matter of sense disappears altogether. The star souls have bodies, but bodies of ether. At the top of the qualitative scale there is God who is pure spirit, pure thought, without any matter. The world of value is staged as an astronomical world in space, and this picture came to dominate scholastic theology and the *Divine Comedy* of Dante. For Aristotle, as for Plato, theology becomes the completion and culmination of the world of science. Your physics, astronomy and biology are not complete without God. You cannot understand the universe if you leave God out. God is the ultimate principle of directive motion—the Unmoved Mover in the teleological world.

While there is continuity in the gradations in Aristotle's system, the forms and levels are eternally fixed. A plant cannot rise to an animal next in the series nor can one type of animal rise to another nor can an animal rise to man. Every individual strives to realize its own form. Acorns realize themselves in striving to become perfect oaks, and dogs in striving to become perfect dogs, and man in striving to become perfect man. There is no transmutation of species in nature. Oaks have always given rise to oaks, dogs to dogs, and man to man. Aristotle does not dream of an ascent from amoeba to man. There is origin of individuals but there is no origin of species. For the precursors of evolution, in the Darwinian sense, we should have to go back to the early Greek naturalists, such as Anaximander and Empedocles.

Matter does not exist as mere indeterminate matter in Aristo-

tle's philosophy. In Plato's myth of creation, matter and form are dramatically opposed, with God as the demiurge bringing order into chaos. But, in the world as it is, matter is more or less formed. And for Aristotle the world as we know it is eternal. There is no transition, as in Stoicism, from one world history to another in which we might observe genetically the formative process. But if primitive matter does not exist in separation, it is no less necessary to postulate it in order to understand the world as it is. It is the raw material out of which our world is constituted; and this raw-material has a necessity of its own. It is the flux in which order is incarnate. Without it there could be no process. And the world under the moon could not exist, because it is always in process of realizing form in matter. The souls of the stars and the heavenly spheres are also incarnate in matter, but this matter, the ether, is different in quality from terrestrial matter, having in it no contrariety and therefore being incapable of change. The only motion of which the spheres, with the stars set in them, are capable is circular motion—an imitation in time of the perfect self-activity of the Unmoved Mover. Only God could exist if all matter were annihilated.

If matter here below is the condition of realization, it is also responsible for the failure of realization. It constitutes the inertia or drag which is increasingly, though never quite, overcome in the hierarchical levels of realization in our world of change. Hence it is that no individual in the world of change quite realizes its form. Matter in Aristotle's system plays the same rôle as in that of Plato. But matter in Aristotle's hierarchy of realization assumes a wider significance. Every stage in the formative process is matter for further reconstruction. Impregnated with form, matter becomes potentiality—the striving for the characteristic form in that particular historic cycle. Hence arises the conception of the relativity of form and matter. What we regard as form or as matter depends within certain limits upon our point of view. When we are retrospective—when we look backward from the selected present—we regard the present as form or actuality. When we are prospective—when we look towards development—we regard the present as potential-

ity. A child is form when viewed with reference to previous development. It is matter, potentiality, when viewed with reference to future development. But in each case the present state of affairs furnishes inertia with reference to higher development. The impulsive nature of man must be disciplined by training and reason before man can live the characteristic life of a rational being. Matter is always inertia with reference to a new level of development. But we must not forget that it is also means for this development and that to a large extent it is plastic to the formative genius of nature. This is true even at the lowest limit. But the idea of relativity cannot be pressed indefinitely. Logically we come to the limit of pure form, absolute actuality, at one end of the scale and the limit of indeterminate matter at the other end. The lower limit does not exist as such though it is implied in the process. The upper limit, God, must exist as such for it is the inspiration of the whole teleological movement, throughout the scale of nature. In nature below man this teleology is unconscious though there must be something akin to love for form throughout. In man it becomes conscious ideal creativeness.

Creative Emergence

Since there is no dramatic beginning of the world, the factors which go to make the world are always compresent in the eternal process. In so far as there is creation, it must be emergent creation. It is surprising how important a rôle emergence plays in Aristotle's conception of the world. While the forms are eternal, forms can exist only as incarnate in individuals; and, in the world under the moon, individuals emerge. Matter as we know it is an eternal emergent. For the matter which exists, viz. the four elements: earth, water, air and fire, is not primal matter. Matter as we observe it is formed matter. Primal matter has taken on qualities, and the union of primal matter with the contrary qualities has taken on the forms of the four elements. It would be a mistake to regard matter as just the union of contrary qualities. For if change proceeds from one contrary to the other, "there must be something under-

lying which changes into the contrary state; for the contraries do not change. Further something persists, but the contrary does not persist; there is, then, some third being besides the contraries, viz. the matter. . . . The matter, then which changes must be capable of both states."[3] The elements embody "two pairs of contraries, warm and cold, dry and moist. Earth is cold and dry, water cold and moist, air warm and moist, fire warm and dry. In this series each term has one quality in common with its neighbour, and in respect to its other fundamental it is contrarily qualified. This explains the constant interchange which is observed to take place between them: the solid melts, the liquid evaporates in air, and the vapours feed the flames. Change is the replacement in a body of contrary by contrary quality."[4] One element can pass into another only when they have a quality in common. If such is not the case, the transformation must be effected through intermediaries. Thus we have an unending cycle of change among the elements. Aristotle's theory of matter seems crude beside Plato's mathematical atomism. But it embodied the results of Greek thought from Anaximander on; and in the emphasis of contraries it might be said to foreshadow the modern conception of matter which involves, as the basis of change, the opposition of positive and negative electric charges. But no doubt the resemblance is far-fetched. The important thing for our purpose is that the elements must be conceived as eternal emergents from primitive matter and the two pairs of contraries: warm and cold, dry and moist. Moreover the elements combine into various compounds with their emergent characteristics.

It is on the biological level, however, that emergence stands out most strikingly as an aspect of Aristotle's philosophy. Nowhere does Aristotle's genius as a scientist stand out more than in embryology. Here he showed such power of combining first-hand observation with hypothesis that he became the prophet of the main outlines of the science of embryology in the future, as well as its founder. He had no worthy successor until William Harvey (1578-1657) who followed in the foot-steps of Aristotle, both as regards method and theory, while correcting

some of his mistakes and adding new data. Harvey named the theory epigenesis (which is descriptively preferable to emergence) in contrast to evolution which then meant preformation and unfoldment. The theory of preformation found its fullest expression in Leibniz who developed it both in embryology and metaphysics. Preformation in the extreme form in which Leibniz adopted it means that the organism is present in its complete structure and parts from the beginning of the life history and in the seed which gives rise to it. The evolution of the individual is merely growth in size. Aristotle enunciates very clearly the opposite doctrine, that of epigenesis or emergence.

Aristotle shares with his time the belief that the lower forms of life sometimes originate directly from the inorganic. This seems contrary to Aristotle's general conception that actuality must precede potentiality. But it probably did not seem so to Aristotle, for he attributed such emergence to the action of the sun on matter, and the sun for him possesses that vital heat which is a factor in generation and which is like the vital heat contributed with the semen in sexual generation. Careful experiments in the nineteenth century disproved the tradition that magots, worms and flies originate spontaneously in putrefaction. But the general idea prevails in science that the lowly beginnings of life originated in some remote period from the action of the sun's rays (perhaps rays no longer communicated); and it has even been suggested by Chamberlin, a geologist, that such origination may still take place though unnoticed by us. As regards the generation of life from life Aristotle recognizes asexual generation as well as sexual, though the latter is predominant in the animal world. In asexual generation the form is potential in the matter, for it is not communicated from outside. It is not to be wondered at that Aristotle considered propagation in plants as asexual since the sexual propagation of plants was first recognized by Linnaeus in the eighteenth century. He also thought that asexual generation takes place among the lower animals; and here he supported theory by observation. He found that the female alone may produce not only females but also males. But it is with sexual generation that Aristotle is

primarily concerned. Here it is evident that life or soul is "the first actuality (entelechy) of a natural body furnished with organs."[5] The soul, according to Aristotle, is communicated by the male parent. The female contributes only the matter or potentiality. The vegetative soul, the power of nourishment and growth, does indeed exist in life spontaneously generated, for we find it in plants and in the lowest animals, and it is possessed to a degree before conjugation by the male and female elements in sexually produced animals. But when Aristotle uses soul in the full sense (i.e. as entelechy), he has the male in mind. It is the father who produces the soul of the progeny as the artist produces the form of the statue.

Aristotle describes in detail the reproductive process. In conjugation the male parent contributes a secretion, the semen, and the female also contributes a secretion, the mensis. Aristotle deals with the respective contributions en masse. The discovery of the minute factors was not possible until high power microscopes were available. The spermatozoon was first discovered by Stephen Hamm and A. van Leeuwenhoeck in 1677, and it was not till 1827 that K. E. VonBaer identified the mammalian ovum. Aristotle had no conception of the cell. This was first described in 1838 by Schleiden, who developed the theory of the growth of an organism from a single cell by cell division. Aristotle appreciates the difficulty "in understanding how the plant is formed out of the seed or any animal out of the semen. Everything that comes into being or is made must (1) be made out of something, (2) be made by the agency of something, and (3) must become something."[6] The agency is the actuality of the father who contributes the semen. The semen contains the principle of soul. "Of this principle there are two kinds; the one is not connected with matter, and belongs to those animals in which is included something divine (to wit, what is called the reason), while the other is inseparable from matter."[7] The principle of soul is permanent throughout the life history of the individual, and for Aristotle embryology is concerned with the whole life cycle from beginning to senescence and death. The soul is the formal cause which guides the process of develop-

ment and makes it a definite whole. It is also the final cause, the end for which the process takes place, viz. the complete and fully functioning individual.

But the soul in the semen has its own peculiar matter, for the soul does not exist as mere abstract form; it is always embodied in matter. The matter of the generating soul is not the ordinary four elements. "Now it is true that the faculty of all kinds of soul seems to have a connexion with a matter different from and more divine than the so-called elements; but as one soul differs from another in honour and dishonour, so differs also the nature of the corresponding matter. All have in their semen that which causes it to be productive, I mean what is called vital heat."[8] Aristotle explains that this vital heat is not ordinary fire "but it is the spiritus included in the semen and the foam-like, and the natural principle in the spiritus, being analogous to the element of the stars", i.e. the ether. It is this spiritus in the sun which makes the heat of the sun capable of generating animals while ordinary fire does not generate life. This ethereal matter which the semen contributes with the soul acts as a sort of catalyst. It does not form any part of the embryo. "The case resembles that of fig-juice which curdles milk, for this too changes without becoming any part of the curdling masses."[9] This spiritus which is contributed with the semen from the male initiates the movement by touching the matter of the female. The movement goes on through the process from part to part, though the spiritus does not itself enter as a part of the process. It has accomplished its work but the soul goes on, and contributes order and wholeness to the emergent parts. The soul enters with the semen "which is only a secretion of the nutriment in process of change."[10] It does not pre-exist as a separate form. It is inseparable from a body. It does not enter from outside the biological process. "It remains, then, for the reason alone so to enter and alone to be divine, for no bodily activity has any connexion with reason."[10]

We come now to the crucial problem of epigenesis or emergence. Aristotle is clear that none of the parts pre-exist in the semen which carries the soul and of course not in the mensis,

the feminine contribution, which is only matter to be formed. "If the whole animal or plant is formed from semen or seed, it is impossible that any part of it should exist ready made in the semen or seed, whether that part be able to make the other parts or no. For it is plain that, if it exists in it from the first, it was made by that which made the semen. But semen must be made first, and that is the function of the generating parent. So, then it is not possible that any part should exist in it, and therefore it has not within itself that which makes the parts."[11] Aristotle satisfied himself, by the observation of embryos in various stages, that the parts originate in succession, "as the knitting of a net", they do not come into being together, "for some of the parts are clearly visible as already existing in the embryo while others are not; that it is not because of their being too small that they are not visible is clear, for the lung is of greater size than the heart, and yet appears later than the heart in the original development."[12] Aristotle dismisses the idea that one part in the succession originates the next in the series. "I mean, for instance, that it is not the fact that the heart, having come into being first, then makes the liver, and the liver again another organ, but that the liver only comes into being *after* the heart, and not by the agency of the heart, as a man becomes a man *after* being a boy, not by his agency. An explanation of this is that, in all the productions of Nature or art, what exists already potentially is brought into being only by what exists actually; therefore if one organ formed another the form and the character of the later organ would have to exist in the earlier, e.g. the form of the liver in the heart."[13] Aristotle himself discovered the emergence of the heart and its throbbing in a hen's egg, but did not find in it the preformation of the later parts. The parts therefore emerge in the life history of the individual, and "the homogeneous parts and the organic come into being together."[14] The rôle of the father is like that of the artist. "For the art is the starting-point and form of the product; only it exists in something else, whereas the movement of Nature exists in the product itself, issuing from another nature which has the form in actuality."[15]

If the parts emerge in the life history, so do of course the characters. There are first of all the characters which emerge as a result of the energizing control by the vital impulse and the soul (carried by the semen) which guide the transformation of the matter of the female secretion towards the fulfillment of the end of the individual and the species. The constant characters of the species are due to this control. Some of these characters involve mechanical causes. "We may allow that hardness and softness, stickiness and brittleness, and whatever other qualities are found in the parts that have life and soul, may be caused by mere heat and cold, yet, when we come to the principle in virtue of which flesh is flesh and bone is bone, that is no longer so; what makes them is the movement set up by the male parent, who is in actuality that out of which the offspring is made in potentiality",[16] i.e. these material characters emerge under the guidance of the actuality contributed through the semen. They form an integral part of the teleological process.

But there are also variant emergent characters which result from the material conditions. Sex is such an emergent character. It depends upon the quantitative proportion of the vital heat, communicated by the male, to the cold passive character of the secretion by the female. Sex is not part of the first cause—the soul communicated with the semen of the father. Aristotle has great confidence in the quantitative ratio of hot to cold as a formula for determining the gradations in the life series generally. This ratio determines whether the individual is generated as a scolex, an egg or a living animal; and this generation in turn determines the place of the animal in the scale of life. But we are here concerned with its relation to sex. When the vital heat, contributed by the male, dominates over the female matter, so as to bring to completion an individual who in turn can secrete semen, we have a male child. When the female secretion dominates we have a female child. The female child is the result of the failure of the maternal matter to respond adequately to the vitalizing touch of the father. The female is a stunted male. But the dominance is a quantitative dominance by either of the material elements which contribute to genera-

tion. The qualitative sex characters are emergents from the quantitative dominance. Strictly speaking it is the female sex which is a material emergent, for the impetus from the father would normally result in the emergence of a male if not frustrated. But while woman is a failure in production, it is necessary that there should be women in the economy of life. In this sense the failure serves a purpose and is sufficiently guaranteed in the material conditions of generation.

The specific characters of the individual follow the dominance of the two lines of heredity. But when Aristotle discusses in detail the resemblance of the offspring to its ancestry he relies more on observation than on his general theory. The simple quantitative ratio which is made to account for sex is obviously insufficient to account in detail for the apparent recurrence of ancestral characters, not only parental but those of more remote ancestors, in the child. Aristotle does not commit the fallacy of reading back the characters into the antecedent conditions. The characters emerge in the process. But in the two lines of heredity there are "movements" or "forces" which, when they prevail, produce the emergent resemblances that we observe. Since causation is primarily individual causation, the movements of the individual parent have a greater chance to prevail than the movements, also carried in the semen, from the more remote ancestors, grandparents for example, or the more generalized movements of the species. The movements of the male parent stand a greater chance of determining the character of the male offspring than does the female parent. But in the process of material realization, there takes place neutralization of movements, and so the male may resemble, in various degrees, the female parent or the grandparents or neither parents nor grandparents but the species. Thus Aristotle accounts for resemblances in the genetic series by the ratio of the predisposing movements or forces. To say that Aristotle here is modern is faint praise. Aristotle gives mechanical causes their due but he sees also that the process is not mere mechanical shuffling.

There are also in both sexes individual variations of parts

and characters which must be attributed to the working of mechanical causes in the specific process of realization. Such are superfluous parts and variations in height, shape, complexion and colour. While the parts and characters which are common to the species, and those which are essential to the fulfillment of the proper functions of an organism of a particular dignity, emerge by virtue of the final cause (i.e. emerge as the result of the guidance of the soul of the particular life history), the variant parts and characters of individuals must be referred to material causes "on the view that these things come into being by necessity"[17] (of the non-teleological sort). "Their course must be sought in the movement or process of coming into being, on the view that the differences which mark them arise in the actual formation of the animal. An eye, for instance, the animal must have of necessity (for the fundamental idea of an animal is of such a kind), but it will have an eye of a particular kind in another sense, not the sense mentioned just above, because it is its nature to act or be acted on in this way or that way."[18] Variations in the characteristics of the life cycle, such as the hair turning grey at a certain stage or not turning grey, must be laid to matter, though Aristotle evidently does not think that the life cycle itself is due merely to material necessity. The variations of such individual parts and characters, as we have noted above, are still consistent with the final cause and so may be said to be in general controlled by it, even though mechanically originated. But there are other variations, such as monstrosities, where matter gets out from under control. Here we may be said to have "materialistic emergence" in the strict sense.

Psychological organs and characters are as truly emergent as are the strictly biological, which have to do with the maintenance and reproduction of life. Aristotle does not make the mistake of separating psychology from biology. He deals with the life history of an individual as one unit. The sense organs emerge in the life history of the individual. Touch is the most primitive and the most universal of the senses, but taste is vital in the nourishment of the organism and smell is closely bound up

with taste. Sight is in general the highest of the senses, but hearing is the most important for thought, because it makes language possible, which is indispensable for thought. Sense qualities are emergent facts, for it requires both the stimulus and the peculiar character of the sense organ for sense qualities to arise. They emerge in the interaction of the stimulus and the sense organ, though when they arise they belong both to objective nature and the sense organ. Colour is only potentially in light. It requires the action of the eye to make it actual. But when colour arises, the light is coloured. Nature has colour as well as the eye. The other sense qualities similarly emerge as a result of the interaction of stimulus and sense organ and are similarly objective when they have emerged. Besides the special senses, it is necessary that there should emerge a common sense, which Aristotle locates in the heart, in order that there may be correlation of the information from the special senses.

The vegetative soul is universal in whatever has life. Before conjugation the semen and the mensis are alive and so possess the vegetative soul in a measure, but it must be actualized in the life history of the individual. Neither semen nor mensis can maintain themselves independently, at any rate not for long. In the history of the animal individual there emerges the sensitive soul, with its characteristics of perception and movement. The sensations, with their qualities, are physical facts, emergents from stimulus and sense-organs. But the forms of things are not emergent. They are impressed upon the sense organs as a ring is impressed upon wax. In the picturesque language of Fuller: "The sense organ sucks only the form from the external object and assimilates it alone, leaving the matter to one side."[19] The soul is the active factor which not merely receives but actualizes the form in the object.[20] The soul becomes the form of the thing and at the same time knows the thing as having a certain form. Memory, in the sense of memory images, is for Aristotle a physical fact, depending upon the particular sense organ.[21] It is a lingering excitement in the sense organ, a faded picture. But recollection is an activity of the soul, which searches among the faded pictures for the one it wants.

Such recollection is made possible by the unconscious laws of association—contiguity and similarity. Desire emerges with imagination on which it depends. Passive reason, the capacity for forming general ideas, is itself an emergent in the maturing of the organism, and is shared by the human being with the animal world. Aristotle makes shrewd observations in comparative psychology. "Psychologically, a child hardly differs for the time being from an animal."[22] The active reason alone, which makes possible the investigation into pure form and its disinterested contemplation, is not an emergent from biological history. It is an ingression from without.

Does the individual soul as such emerge? Aristotle dodges this question; or perhaps it would be truer to say that he did not see any problem. He is so confident that the father is the actuality and is adequate to produce the seed, which gives form and impetus to a new life series, that he does not feel the need of inquiring farther. The analogy of the artist is always in his mind. The artist produces the form of the work of art which he creates. But the creation of a new form has a beginning in the artist's mind. It did not actually pre-exist in his mind indefinitely. If the father is the maker of the form of a new individual history, the form had a beginning. Leibniz' idea that all souls pre-existed in the first parent would be meaningless to Aristotle, for, in the first place, there is no first parent and, in the second place, which is more relevant, the seed of the father is just a differentiation of "nourishment," which only becomes seed in the act of conjugation. The soul of the new individual could not therefore have actually pre-existed in the father. In the *Metaphysics,* Book XII, 1071a Aristotle distinguishes between the father as the proximate cause, on the one hand, and "the peculiar form" of the individual, on the other. In this relation of actuality to potentiality both the matter and the form are different in the effect from the cause. Here he seems to hold to emergence of soul.

Aristotle is clear that each life history has its own soul which is not the soul of any one else. It is not the continuity of the species, for the species is a universal, while the soul is individual.

Had Aristotle realized that both parents contribute in an equally important way to the genesis of the new individual, the problem would not have been so simple for him. Aristotle rejects the theory of metempsychosis because for him that means that any soul might take on any body, forgetting that in metempsychosis souls are supposed to elect the appropriate heredity. But if souls do not pre-exist in the father and do not come from outside (except the rational soul), it seems they must emerge. The emergence of individual soul-forms, however, is contrary to Aristotle's general assumption that forms are eternal. But, on the other hand, he is of the opinion that biological souls generally perish. If they can perish, why can they not emerge? Aristotle,on the whole, seems to think that what is eternal must always endure in time though we shall see that this view raises difficulties for him. But the demiurge in the *Timaeus* created the forms in the beginning, yet for Plato the forms are eternal. The eternal may mean that which makes a process significant, gives it substance, in the sense of meaning, however brief its duration may be. Such a conception of the eternal is uncongenial to Aristotle. But Aristotle, in his conception of a dynamic whole-form of individual life, made an immortal contribution of which biology is yet to avail itself.

Human personality is an emergent. It presupposes the biological evolution of the individual with its emergent stages and characters under the guidance of the entelechy of the process. But a new ingredient of another order must enter into the life history for the emergence of personality. There must be the union of a rational soul* with the biological history of the individual. The rational soul is a sort of catalytic agent which, while it establishes a new type of control of the biological individual, remains pure and unaffected. It is a distinct type, "and it alone is capable of existing in a state of separation from the body, as the eternal is separable from the mortal."[23]

* It would seem that the same objections which Aristotle raises against metempsychosis in general might be raised against the rational soul entering the genetic process from without. But Aristotle does not recognize this difficulty. As usual the objection he urges against Plato recoils on himself.

Whence, how and when the rational soul enters, Aristotle does not venture to suggest. It must have existed before the biological individual and will exist after the body perishes. "In its separated state alone reason is what it is, immortal and eternal. We have no memory of it because this part of reason is impassive. The passive reason, on the other hand, is perishable, and without it there can be no thought."[24] The active reason alone survives, "for doubtless it is impossible that all soul should survive."[25] Reason survives because it is not the realization of any bodily nature. "And yet it is uncertain whether the soul as a realization of the body is separable from it in a sense analogous to the separability of sailor and boat."[26] We can only be sure that the rational part is separable. We know the rational soul only functionally, and it is because of its ingression into biological history that creative human personality emerges. (But Aristotle's artificial separation of the rational soul makes him fall short of the integral conception of creative personality.) The rational soul depends upon the biological organism for realizing itself in its environment. It uses the mechanisms of the organism—sensation, perception, memory, imagination, as well as the motor mechanisms—for realizing the unique life of a rational being.

It is the presence of this divine part in man which sets his highest vocation—disinterested creativeness and contemplation which exceed in dignity the practical virtues, so necessary for our social life. In pursuit of this theoretical activity man rises beyond the life of mere man. "Such a life would be too high for man; for it is not in so far as he is man that he will live so, but in so far as something divine is present in him; and by so much as this is superior to our composite nature is its activity superior to that which is the exercise of the other kind of virtue. If reason is divine, then, in comparison with man, the life according to it is divine. This life of reason is, it would seem, each man himself, since it is the authoritative and better part of him. It would be strange, then, if he were to choose not the life of his self but that of something else."[27] Aristotle in an eloquent appeal suggests that we may win immortality in very

much the same manner as suggested by St. Paul later.[28] "We must not follow those who advise us, being men, to think of human beings, and being mortal, of mortal things, but must, so far as we can, make ourselves immortal and strain every nerve to live in accordance with the best thing in us." Here it would seem that personal immortality may emerge from the highest endeavor in this existence; and this, I take it, is something more significant than the mere persistence of the rational soul which is inevitable. By living the divine life we may share the immortality of God and the bliss of God, whose activity is supposed to be pure theoretical activity.

If the highest personal life is an emergent, so is evil an emergent. There is no evil in God. Nor is matter as such evil. But at each level there is the inertia of the lower to further advance. "There is no evil apart from particular things." Evil emerges as a result of process. "Evil in other words is not a necessary feature of the universe but a by-product of the world-process, something that casually emerges in the course of the endeavor of individual things to reach such a perfection as is open to them, and thus to approximate as nearly as they can to the divine life."[29] (But it would seem at any rate that the inferiority of the sublunary matter is an eternal fact.)

In a still wider sense, Aristotle believes that events emerge. He is not an absolute determinist. "In the *De Interpretatione* he denies the applicability of the law of excluded middle to statements about particular future events. To assert its applicability is to say that nothing happens by chance. . . . As against this, Aristotle asserts that deliberation and action form genuine starting-points for subsequent events. But to put the matter more generally things which do not always energize are capable of either acting or not acting, i.e., there is contingency even apart from human actions. In some cases the assertion is no more true than the denial nor vice versa; in others the one has a great tendency to be true but the others may be true. . . . There must either be or not be a sea-fight tomorrow, but it is not the case either that there must be or that there must not be one."[30] So far as the process realizes a form, we can have

prediction. We can predict where we have recurrent series of events. But opposed to the necessity of law, there is blind necessity or contingency, a certain indeterminate pluralism in the world process. Of this there can be no prediction. "There can be no science of a world of flux." Events emerge by the union of form with contingency in the world of process. When we deal with such potencies as productive forms of knowledge or rational potencies we have to do with another kind of contingency from that of non-rational potencies, for the latter can produce only one effect under given conditions, while the former can produce contrary effects.[81]

It is clear now how large the rôle of emergence is in Aristotle's philosophy. Wherever there is temporal process, there is emergence. Particular things, particular individuals emerge. The world in the concrete is an emergent world. Aside from Aristotle's mythological astronomy, everything emerges except God and the abstract forms, which, however, exist only in emergent individual things. How they could be immanent in concrete individual things when they are never quite realized in concrete individuals is a discrepancy which Aristotle does not see. It seems they must have some other mode of subsistence than in individual histories, if they transcend individual realization. But Aristotle at least tries to be a genuine emergentist. He does not play hide and seek between appearance and reality, as modern idealists have done. His account of reality is of one piece. He takes time seriously. "Time is either identical with motion or part of motion." And motion is eternal.

There is real pluralism in Aristotle's world. It is true that change is bound up with imperfection. But the imperfection involved in process is not to be got rid of by shifting from the finite to the absolute point of view. It is due to the fact that realization in the world of temporal process implies matter, with its own necessity, which is not a function of the necessity implied in order, but is an independent fact and furnishes inertia to ideal realization. If matter were derived from God, as in scholastic theology, then everything would follow from the nature of God. This should lead to a thorough-going pan-

theism. Scholasticism tried to save itself by its doctrine of creation. But matter for Aristotle does not derive from God. God does not create matter. God is perfect but not omnipotent. Science deals with form, but scientific knowledge of the sublunary world is limited by empirical conditions and empirical individuality. There can be no *a priori* knowledge of the concrete. There can be only probabilities.

Emergence and Substance

What is the relation of this emergent world to reality? Aristotle shares in large part Plato's prejudice against the temporal. Substance *(ousia)* must be eternal. Truth has to do with the unchanging. "We must not make the things that change the basis of our judgment of truth. For in pursuing the truth one must start from the things that are always in the same state and suffer no change. Such are the heavenly bodies, for these do not appear now of one nature and again of another, but are manifestly always the same and share in no change."[32] The substance which we mean in our judgments of truth must be eternal. Therefore, changing things cannot be substances. Substance must also be individual according to Aristotle, for individuals alone ultimately exist. What is required is individuals who can be eternal. No wonder Aristotle became more and more absorbed in astronomy. For only the heavenly bodies and God manifestly answer the requirements of eternal individuals—the former because their ethereal bodies are as changeless as their souls, the latter because there is no matter in God at all. If this conception seems to ignore our sensible world, Aristotle replies: "Only that region of the sensible world which immediately surrounds us is always in process of destruction and generation; but this is—so to speak—not even a fraction of the whole."[33] But Aristotle, after all, has his feet upon the ground and is concerned mostly with the world under the moon. What then does substance mean in this, our changing world?

We are not concerned here with Aristotle's grammatical use of substance as the subject of a sentence. In this sense, individual names or nouns *must* be substances, since they cannot be used as predicates. Predicates must be thought of as inhering in individuals. Accordingly, the controversy over the relation of predicates to individuals played a large rôle in the Middle Ages; but here we are concerned with Aristotle's metaphysical conception of substance.

Commentators have long accused Aristotle of confusing dif-

ferent meanings of substance (*ousia*).* But we must remember that Aristotle gives the generally recognized meanings of substance—both those current among the naturalists and in the Academy—and then criticizes these conceptions in terms of his own theory. He is obliged to deny that the universal is a substance, for while the universal is eternal it is not an individual. But Aristotle is too much of a Platonist to deny reality entirely to the universals. For the universal—animal or man—enters into the characterization of a thing. He therefore makes the distinction between primary and secondary substance. "By a primary substance *(prōtê ousia)*, I mean one which does not imply the presence of something in something else, i.e., in a substrate *(hupokeimenon)* which acts as matter (*hulê*)."** He concedes, however, that the universal may be called secondary substance *(deutera ousia)*. Perhaps the clearest summing up of the conceptions of substance is in the *De Anima*: "Substance *(ousia)* is employed in a threefold mean-

* He enumerates "the generally recognized substances" (which are "the sensible substances and sensible substances all have matter") as three, viz. (1) as substrate (ὑποκείμενον) which may be matter (ὕλη); (2) as form or shape (εἶδος) and (3) as the composite of these two, "which alone is generated and destroyed and is, without qualification, capable of separate existence." (*Metaphysics*, VIII, 1042a, 24-31.)

** *Met.*, VII, 1037b, 2-4. It is difficult to render the variety of Aristotle's technical terms into English, and the translations are apt to mislead because of the change in the intellectual climate. The reader must be guided by the context. The terms which concern us particularly and which play into one another in Aristotle's attempt to define substance (οὐσία) are form or shape (εἶδος); formula, measure or definition (λόγος); essence (τί ἦν εἶναι), which makes a thing definable. Substance as form is "cause" (αἰτία) as the guidance of the process, as contrasted with matter which is a cause (αἰτία) in the sense of a factor to be formed. As a principle of explanation it is (ἀρχή). It is nature (φύσις) as immanent drive. It is actuality (ἐνέργεια) as complete realization. These terms when used in an ultimate sense, i.e. of individuals, become equivalent. The substance (οὐσία) is the form (εἶδος) of an actual individual. And as the form it is the essence or meaning (τὸ τί ἦν εἶναι) which is the aim of definition (λόγος); and the substance as form is the guiding cause or control. As the meaning of the process substance is formal cause, as drive it is the efficient cause, as end it is the final cause (τέλος). Substance is the principle of explanation (ἀρχή) of the history of an individual which as realized is actuality (ἐνέργεια) which is the ultimate cause of movement in matter (ὕλη) and accounts for its potentiality (δύναμις). Anything is matter (ὕλη) or substrate (ὑποκείμενον) which is to be formed or made definite, whether it is naturalistic matter such as earth, water, air and fire, or a logical genus (γένος) which is broken up into species by differences. Here too, however, the ultimately existent is the individual or primary substance (πρώτη οὐσία).

ing, viz. (1) as form (*eidos*), (2) as matter (*hulê*) and (3) as a composite of these two. Amongst these meanings of substance, matter signifies potentiality *(dunamis)*; form signifies actuality *(energeia)* or complete realization."[84] Potentiality owes its significance to the realization of form. Therefore Aristotle speaks of the form *(eidos)* as the substance *(ousia)*. The form is the essence or meaning (*to ti ên einai*) of the process. Form and essence, when used in an ultimate sense, i.e., of individuals, are equivalent. The form is the essence of the individual. And the form or essence is that which makes a formula or definition *(logos)* possible. The meaning is the substance of the process in the sense that we speak of discourse as having substance or lacking substance (usually the latter). It is, moreover, the individual meaning which is the final substance of the process, not the abstract meaning, the universal. The latter is substantial in only a derived or secondary sense. It is relevant of individuals. But it cannot exist apart from them. "No 'animal' exists apart from the particular forms of animals."[85]

In God there is no matter, and therefore the distinction of form and matter is irrelevant. In the heavenly bodies the matter, being simple and unchangeable, is an eternal vehicle of form; and therefore we are not concerned with the matter. But in the world of becoming, an inferior matter has its own contrariety and contingency. Here, therefore, we must distinguish between form and matter. For logical analysis, at any rate, the form is separable from the matter. The concrete things in our world of change are not true substances for they come into being and perish. But substance must be eternal, else how could it give meaning to the whole process? In the concrete process, moreover, there are emergent properties which are due to matter and which are not part of the substance of the process. There is "in a sense a formula (*logos*) of the concrete individual but there is no formula of it with its matter, for this is indefinite; there is a formula of it only with reference to its primary substance—e.g. in the case of man the formula of the soul—for the substance is the indwelling form, from which and the matter the concrete substance is derived".[86] While this primary sub-

stance is incarnated in matter, it is not essentially matter. Substance as form is that which makes a concrete thing an individual whether a house or Socrates. Substance gives meaning to the process and "only substance is definable."[37] Substance is the "why" of a process. "The 'why' is always sought in this form—why does an attribute attach to a given subject? . . . Now why a thing is itself is doubtless a meaningless enquiry. But we can enquire, why man is an animal of such and such a nature? And why are certain things, i.e. stones and bricks a house? There what we seek is the cause, i.e. the form by reason of which matter is some definite thing; and this is the substance of a thing."[38] It is to be noted that it is the substance (*ousia*) as form (*eidos*) which makes the matter a definite thing—a "this-such", and not a mere "this"—whether the thing be Socrates or a bronze vase.

By substance, then, Aristotle means what I have called structure. By means of creative thought we try to express the form in a formula; and if the formula is true, it states the structure of the thing intended. At the end of the first book of the *Metaphysics,* Aristotle tells us that Empedocles had an intuition of something of this sort. "For even Empedocles says bone exists by virtue of the ratio (*logos*) in it. Now this is the essence and the substance (*ousia*) of the thing. But it is similarly necessary that the ratio should be the substance of flesh and of everything else, or of none; therefore it is on account of this that flesh and bone and everything else will exist, and not on account of the matter, which *he* names—fire and earth and water and air. But while he would necessarily have agreed if another had said this, he has not said it clearly."[39]

The substance (*ousia*) of a thing is its organizing pattern or whole-form as realized in the process. The drive in the universe is the drive of logic or, perhaps better, the drive of aesthetics of which logic itself is a part. Aristotle's universe is "a whole-making universe."* This conception of a whole-form

* This phrase and conception has been emphasized in the Aristotelian spirit by J. C. Smuts, *Holism and Evolution,* 1926. See the author's *A Realistic Universe,* 1916, 1931, Chaps. III and XIII; also *Cosmic Evolution,* 1925. An eminent biologist, W. E. Ritter, has convincingly established the organismic conception in Aristotle.

which is whole-making, not only in space but in time, is Aristotle's immortal contribution to both science and philosophy. A whole is not just a heap or collection of elements. "The product must be different from the elements."[40] When the elements are organized into a whole, a new reality emerges. The elements take on substance or meaning. "As regards that which is compounded out of something so that the whole is one—not like a heap, however, but like a syllable,—the syllable is not its elements, *ba* is not the same as *b* and *a*, nor is flesh fire and earth; for when they are dissolved the wholes, i.e. the flesh and the syllable, no longer exist, but the elements of the syllable exist, and so do fire and earth."[41] In the language of Aristotle what the whole is over and above the parts, i.e. the whole-form, "is the cause which makes *this* thing flesh and *that* a syllable. And similarly in all other cases. And this is the substance of each thing; for this is the primary cause of its being." Looked at genetically, substance is the active principle or formative pattern which organizes the matter into a typical whole, as seen in human genesis. While form and matter are logically distinct, they are not existentially separated; for form (except in God) does not exist except as incarnate in matter and there is no matter without some form. The actual is the formed individual, and it is only actual things that act. "And it is a peculiarity of substance that there must exist beforehand another actual substance which produces it, e.g. for an animal if an animal is produced."

The species is not an active agency. The universal is only effective as an aspect of the individual. "There is no universal man, but Peleus is the originative principle of Achilles, and your father of you, and this particular *b* of this particular *ba*."[42] If we have regard to generation, we may look upon the father as the formal and efficient cause; but if we have regard to individual history, then the father becomes "the proximate cause in actuality" (i.e. the cause of the form) and the mother "the proximate cause in potentiality" (i.e. the cause of the matter). But from the factors a new individual with a new form emerges. The form of the father is not the form of the new individual. We have here to do with a case of actuality and potentiality

where the form is not the same as that of the proximate cause but different.[43] The formal and efficient cause of the new individual is peculiar to that individual. To give a full account of "the cause of man" according to Aristotle we should have to name "(1) the elements in man (viz. fire and earth as matter, and the peculiar form), and further (2) something else outside, i.e. the father; and (3) besides these the sun and its oblique course."[44] It is clear then that the individual form is a distinct cause and that the form of the generated individual is not to be identified with the form of the father, much less with the race which is a universal. It always holds that "that which is first in respect of complete reality is the cause of all things,"[45] and that is the individual substance. Every individual history must be understood through its own form, though the full understanding of the life of man must include the proximate causes. Aristotle then generalizes his analysis of the cause of man so as to apply to all causality: "Different things have different causes and elements, as was said; the causes of things that are not in the same class, e.g. of colours and sounds, of substances and quantities, are different except in an analogical sense; and those of things in the same species are different, not in species, but in the sense that the causes of different individuals are different, your matter and form and moving cause being different from mine, while in the universal formula they are the same."*

It is in dealing with the relation of soul to body that we get Aristotle's clearest statement of substance. "The soul is the primary substance and the body is its matter."[46] And again "the soul of animals is their substance."[47] Viewed in internal regard, the soul is the purpose or meaning of individual activity; the body is the matter to be formed. But Aristotle also

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* *Met.*, XII, 1071a, 25-30. I cannot agree with Jaeger that Bk. XII as it stands is an early work of Aristotle's, while Bk. VII is a late work. Bk. VII with its appendix Bk. VIII is evidently part of one corpus with Bk. XII. Moreover, Jaeger recognizes that Chapter VIII of Bk. XII is part of Aristotle's latest speculations. To maintain that Chapter VIII is an interpolation (of notes of Aristotle) by a later hand is carrying theory too far. I think that we may regard Bk. XII as spanning the whole history of Aristotle's metaphysical thinking—revised up to his death.

tries to state soul in external regard, or in naturalistic terms, as an aspect of the organism: "The soul is not itself body, but is a certain aspect of body, and is consequently found in a body, and furthermore in a body of such and such a kind. . . . For complete realization in every instance is naturally found in a definite potentiality and in an appropriate matter. From this it is evident that the soul is a kind of realization and expressed idea of a determinate potentiality."[48] The soul may be viewed as the functional aspect of the body. "As vision and pupil on the one hand constitute the eye, so soul and body in the other case constitute the living animal."[49] The soul, then, is a certain body in action. It may be regarded as instrumental to the realization of the body. "The soul is analogous to the hand; for as the hand is the tool of tools, so the mind is the form of forms and sense the form of sensible things,"[50] i.e. the soul is the instrument by means of which we seize upon all forms, sensible and intelligible.

This sounds very behavioristic. But this is due to the ambiguity of language. Aristotle sometimes uses body for the whole individual, i.e. the organism regarded from the structural point of view. And the soul is the whole individual in the process of realization, i.e. the individual as being formed or organized in terms of the entelechy of the whole. But the soul is known only in the complete process of temporal realization. "Human thought, or rather the thought of composite objects, is in a certain period of time (for it does not possess the good at this moment or at that, but its best, being something different from it, is attained only in a whole period of time)."[51] The complete realization is always something beyond and, owing to the inertia of matter, never quite realized. Only God is eternally realized, because God is pure thinking and pure thinking has itself for its object. There is no matter in God. There is a difference in quality between the soul, viewed from within as the end or form of realization, and the body externally regarded. It is only as regarded from within that we can glimpse the wholeness of meaning or direction which is the soul of the individual history. We can never grasp this when we view the individual

in external regard as composed of bodily parts. This is true even when we regard the animal soul, for we must view the individual as history, guided by an aim, a pattern striving for incarnation in it; and no history is a perfect realization of its form.

The contrast between the internal regard and the external regard becomes more striking when we consider a human history. For in the creative intelligence of man we have a function which cannot be explained from the biological history of the individual. The capacity to criticize and to create transcends the routine of nature. To understand it, we must postulate a non-naturalistic principle which in some way enters into union with the biological individual. While this principle or entity functions through the body in this existence, it does not derive from the body and is separable from the body, not only notionally but actually, though it cannot remember its separate existence since memory is conditioned by the body. The functional conception of the soul in Aristotle does not mean just the body functioning, but the body functioning at a certain level, in obedience to a certain pattern of the whole which cannot be entirely expressed in material terms. This whole-pattern is the substance of the individual life. "The soul is that principle by which in an ultimate sense we live and feel and think; so that it is a sort of ratio or form, not matter and substrate. . . . Inasmuch as it is the composite which is the animate creature, body cannot be regarded as the complete realization of the soul, but the soul is the realization of a given body."[52] The organic individual is an emergent in the temporal process of this realization of pattern in the form of biological heredity. The divine quality of the highest human realization is made possible by the incarnation of a higher type of pattern from without the biological process. This new type of whole is the substance, the meaning of man at his best.

In the temporal process of emergence, the meaning, the substance of the individual is only imperfectly revealed even at best. If the actual is the inspiration of the striving for meaning, there must be a being who is pure actuality, absolute substance. God is the apex of the hierarchy of value, pure spirit

without matter. Everything individual emerges except God. (The stars may be regarded as eternal emergents in ethereal matter). God is the rationale of the emergence throughout the levels of nature. God is the source of movement in the sense of being the inspiration to realization. "It is necessary that there should be an eternal immovable substance. . . . It is impossible that movement should either come into being or cease to be, for it must always have existed. . . . There must then be such a principle whose essence is actuality."[53] By motion here Aristotle means teleological motion—the motion from potentiality to actuality in the realization of a form.

Aristotle gives but grudging recognition to what we call mechanical motion, though he recognizes its existence. There is a blind necessity as contrasted with teleological necessity. To quote Ross: "Many natural phenomena are due to absolute necessity. They flow inevitably from the nature of matter. Sometimes this absolute necessity subserves ends. The light must pass through the lantern because its particles are finer than the pores of the horn, but in doing so it serves to save us from stumbling."[54] The process of temporal emergence is a mixture of mechanical necessity and teleological necessity, as we have seen in biological emergence. But the universe is intelligible only in so far as it realizes ideas. Only so can there be science and art. In so far as the universe works as an artist, it is scientifically statable. The universe is a whole-making universe. Form exists only as incarnate in individuals. Substance is the meaning of things. God is the substance (*ousia*) of the whole, because God is the good and the beautiful, the final cause (*telos*) of the cosmos. God is the inspiration of the whole-making process, and it is because of God that everything strives to realize perfection according to its kind.

While God is the apex of the cosmic hierarchy of value, he is not just a category. Throughout his account of reality Aristotle is true to his conception that form must be immanent in individuals. God is an individual life. "And life also belongs to God; for the actuality of thought is life, and God is that actuality; and God's self-dependent actuality is life most good

and eternal. We say, therefore, that God is a living being, eternal, most good, so that life and duration, continuous and eternal, belong to God; for this *is* God."[55] We must understand God through our highest, "the divine element which thought seems to contain", though we must think of God as better than our best moments. The divine substance "is eternal and unmovable and separate from sensible things. It has been shown also that this substance cannot have any magnitude, but is without parts and indivisible. For it produces movement through infinite time but nothing finite has infinite power."[56] Since the temporal process is a passing from potentiality to actuality, with its consequent imperfection even at best, God must transcend the temporal process. Time is "number of motion" and motion is imperfect *energeia,* therefore perfect *energeia* is timeless. If God were in a process of realization, we should have no rationale for realization. God's activity must be activity for its own sake and his happiness is the happiness of perfect activity. Aristotle's God cannot love the creatures below him or share in their suffering. He is absolutely self-contained.

What activity can there be left for God? According to Aristotle it must be theoretical activity. It is the thinking of thinking itself: "Therefore it must be itself that divine thought thinks (since it is the most excellent of things), and its thinking is a thinking on thinking. . . . In some cases the knowledge is the object. In the productive sciences (if we abstract from the matter) the substance in the sense of essence, and in the theoretical sciences the formula or the act of thinking, *is* the object. As, then, thought and the object of thought are not different in the case of things that are not matter, the divine thought and its object will be the same, i.e. the divine thinking will be one with the object of its thought."[57] The object of the divine thinking is a unity or whole. "If it were composite, thought would change in passing from part to part of the whole. We answer that everything which has not matter is indivisible." God's thinking and the object of his thought are not temporal processes. They can have nothing to do with motion from potentiality to actuality. God's thinking is *sub species aeternitatis.* There

is no coming into being or passing away for God. The world of contingency and novelty does not touch God.

God's activity is circular activity. To those enamoured with the idea of progress, such activity must seem monotonous. But we must remember that the perfect cannot progress. Only the imperfect can progress. And if there were no perfect, progress could have no meaning. There must be infinite delight in repeating perfect activity.[58] Browning tells us:

> That's the wise thrush; he sings each song twice over,
> Lest you should think he never could recapture
> The first fine careless rapture.

And what rapture there must be in repeating the perfect symphony. The child like the thrush exults in the repetition of the delightful activity, and it has been said that we must enter the kingdom of heaven as little children. What is important for Aristotle is that God shall furnish the standard of striving and value of all this imperfect world.

What does God think in thinking himself? Does God think all the pure forms in their hierarchical unity within one whole of meaning and value? Are all forms present in the divine substance (*ousia*) as they are present, at least potentially, in our soul? Aristotle did not think through this final problem. The way was open to Aristotle to make the divine thought the inclusive thought of thought as science is the inclusive unity of essences. This was the road that Hegel took in the development of his logical idealism. Such unity would not be composite in Aristotle's sense, since composite for him has to do with matter and temporal process. St. Thomas Aquinas interprets Aristotle as meaning that God knows all things through their forms or causes. But for St. Thomas the forms all emanate from God and matter itself is a function of God. God is the source of all existence. God can, therefore, know the universe as creator. But Aristotle's God does not create the forms nor does he create the primal matter with its necessity.

Even if Aristotle's God knew the whole hierarchy of forms, he would not know the contingent world of existence. He would not know primal matter nor mechanical necessity nor absolute

contingence for these do not derive from form. They belong to the world of flux. Since these non-teleological characteristics are part of the temporal world and cause the limitations and failures in this temporal world, God could not know this emergent temporal world nor is it his concern to know it. God knows only himself as the absolute substance—form eternally realized. Nor is it any concern of God's that this finite temporal world shall attain realization. Yet in some way he makes "contact" with this pluralistic temporal world and contributes wholeness to it, so far as it is capable of incarnating wholeness. What he contributes by "contact" is the love for form, the striving for perfection. Aristotle's God, like the scholastic God, cannot be said to love the world, for he is immutable. But in some mysterious way he inspires love in the finite. He dominates the world of existence, so far as there is goodness, beauty, meaning in it, but he does not dominate the world completely, because everything is not good and beautiful, and nothing is absolutely good but God.

It is plain that the ideals of omnipotence and omniscience are not relevant to Aristotle's conception of God. Aristotle's God is transcendent in the quality of his individuality. He is the Apollo of Greek philosophy—the absolute patron of art and science and the beautiful life. Scholasticism confused logical genesis with creation. It inverted the pyramid of logical classification and generated the less general from the more general and everything from being. The scholastic God is conceived as being, in the sense of the source of all existence. Aristotle's God is being, but not in the sense of the source of existence, but in the sense of the ultimate meaning and perfection. Aristotle's God is the acme of the universe, but not its base. He is the source of worth, not of existence. A world of some sort—a hurly burly world—would exist without God, but it would have no meaning, no worth. Aristotle's God is a potent factor in the world by merely existing as perfection; but he is not concerned with the world. He exists in magnificent self-sufficiency. Aristotle speaks of "contact", but it is the contact of mind, of an idea. If things as they are were satisfactory,

Aristotle would no doubt have been in favor of immanence, in the sense that nature is immanent in the routine of nature. He would then have had substance in a Spinozistic sense. Since the world is imperfect, the transcendence of God is the necessary consequence, for an imperfect God would be a contradiction. Aristotle, like Plato, faces the imperfection of the world squarely and tries to make his cosmology account for it. Spinoza's substance and the absolute of modern idealism unify the world completely in God and then admit its pluralistic blindness through the back-door of finitude.

The problem is how to conceive a transcendent God who is effective. If God is just the limit of our thought he is no longer God. Aristotle did think about the problem: "We must consider also in which of two ways the nature of the universe contains the good or the highest good, whether as something separate and by itself, or as the order of the parts. Probably in both ways, as an army does. For the good is found both in the order and in the leader, and more in the latter; for he does not depend on the order but it depends on him. And all things are ordered together somehow, but not all alike,—both fishes and fowls and plants; and the world is not such that one thing has nothing to do with another, but they are connected. For all are ordered together to one end."[59] In so far as the universe is a whole, there must be a whole-form, a substance of the whole. And this must be God. In some way then God must pervade the temporal process, at the same time that he transcends it in the sense of not having his perfection marred by it. But Aristotle stops at the threshold of the problem, perhaps the angel of death stopped his hand in the midst of his labor. It is certain that Aristotle does not, as Plato in the tenth book of the *Laws*, conceive God as a providence interested in the details of the management of the universe. Aristotle's God is too statuesque and cold to appeal to the human heart. But Plato and Aristotle should receive credit for conceiving God as spirit four hundred years before the Fourth Gospel.

It is interesting to speculate how Aristotle would have accommodated his conception of the actuality of form, as a condi-

tion of the order of emergence, to evolution as we understand it. In Aristotle's single world the higher stages are eternally compresent with the lower. In order for the actual to be compresent with the potential, in a world where forms and levels emerge, there must be different world histories at various stages of development so that the actual in one world history can guide the emergence in another history. This problem Aristotle did not feel called upon to face; I have attempted to do so in *Cosmic Evolution.*[60]

The Principle of Individuation.[*]

It is certainly one of the ironies of history that the philosopher who used all his resources to prove that the ultimate substance is individual, and not universal, should have been interpreted to hold that the species is the substance and that the body is the principle of individuation. It is a comic illustration of how history is written. One eminent historian makes a mistake and this is afterwards handed down through the ages. This mistaken interpretation of Aristotle was made in the atmosphere of the realistic tradition of the Middle Ages which made the universal the ultimately real and which had difficulty in finding any ground for the individual. St. Thomas had the happy idea that matter might be made responsible for individuation—of course not just matter in general but quantitatively determinate matter. And how does matter become quantitatively determinate? God creates it for the purpose that there may be individuals. Otherwise there would be just species. We are not concerned here with St. Thomas' ingenious hypothesis and its difficulties, but with his fathering it on Aristotle; and this fathering has stuck. St. Thomas was dependent, as he knew little Greek, on a translation—coloured by Arab tradition and the tradition of scholasticism generally—of an elliptical passage in Aristotle's

[*] This somewhat technical section may be omitted by the general reader. I feel very apologetic about this section, especially to my friend, the great Aristotelian scholar, W. D. Ross, to whose work as editor and translator the English speaking world is so profoundly indebted and without which this paper would not have been written.

Metaphysics. The passage in the Greek is: τὸ δ'ὅταν ἤδη τοιόνδε εἶδος ἐν ταῖσδε ταῖς σαρξὶ καὶ ὀστοῖς Καλλίας καὶ* Σωκράτης. καὶ ἕτερον μὲν διὰ τὴν ὕλην, ἑτέρα ταὐτὸ δε τῷ γὰρ, εἴδει. ἄταμον γὰρ τὸ εἶδος. W. D. Ross follows the tradition in translating the passage: "When we have the whole, such and such a form in this flesh and in these bones, this is Callias or Socrates; and they are different in virtue of their matter (for that is different), but the same in form; for their form is indivisible."[61] Since the form is the soul, that would mean that Callias and Socrates have only one soul between them, and this they would share with all other men.

It is incredible, therefore, that Aristotle should have meant, in the passage above referred to, that Socrates and Callias are the same in form and merely different in body. Did the great Aristotle nap in this passage? It is more likely that his commentators have napped. In the first place, it is clear that Aristotle is talking about the form as the whole-making form of an individual. "When we have the whole, such and such a form in this flesh and in these bones, this is Callias or Socrates."[62] There can be no doubt that he is here using form distributively. The rest of the passage is very elliptical: καὶ ἕτερον μὲν διὰ τὴν ὕλην, ἑτέρα γὰρ, ταὐτὸ δε τῷ εἴδει. ἄτομον γὰρ τὸ εἶδος. I believe that here also form is meant to be taken distributively: "And (the whole, i.e. Callias or Socrates) is heterogeneous** owing to the matter (i.e. consisting of parts such as flesh and bones), for (the matter is) heterogeneous (as contrasted with the ethereal matter of the stars), but (the whole i.e. Callias or Socrates) is the same in form (i.e. the form is one throughout the heterogeneous parts), for the form is indivisible." Each is a this-such. The genetic process is the generating a such out of a this,

* καί is here equivalent to a comma, i.e. Callias, Socrates are different examples. This use of καί is frequent in Aristotle (though he sometimes uses ἤ in the same sense). I am told by my friend, F. Carter, that this usage is frequent in Greek literature generally. Ross here translates καί in this sense by "or". But immediately afterwards, without any apparent excuse in the text, he takes it as additive.

** Diverse in its old English usage, where diverse, like *heteron*, sometimes has a reflexive, sometimes an external reference.

so as to give a concrete individual, whether the producer is an artist or a father. "And the whole 'this', Callias or (*kai*) Socrates, is analogous to this bronze sphere, but man or animal to bronze sphere in general". (Aristotle certainly could not mean that Callias and Socrates together are analogous to this bronze sphere.) The problem of the whole paragraph is: Are there self-subsistent forms apart from individual things—"a sphere apart from the individual spheres or a house apart from the bricks"? The Platonists said that the form cannot be immanent in matter for matter is a *heteron*—a changing manifold—while the form is eternal and indivisible. Aristotle replies that through creative production we come to have just such immanence: "The begetter is adequate to the making of the product and to the causing of the form in the matter. And when we have the whole, such and such a form in this flesh and in these bones, this is Callias or Socrates." The whole-form of the heterogeneous body is eternal and indivisible, though its matter is changing and manifold. "Obviously therefore it is quite unnecessary to set up a Form as a pattern" i.e. as something self-subsistent, to be copied.

That *heteron** here refers to heterogeneity within the concrete individual and not, as in Plato's *Sophist,* to the fact that one thing or quality is different (other) *from* another, can be illustrated by a passage in the *Timaeus* which Aristotle, I think, had in mind in this argument. Plato discusses the creation of the soul which is "in origin and excellence prior to and older than the body, to be the ruler and mistress to whom the body is subject. And the soul he made out of the following elements and on this manner: he took of the unchangeable and indivisible essence, and also of the divisible and corporeal which is generated, and he made a third sort of intermediate essence out of them both, partaking of the nature of the same (ταὐτοῦ and the other (τοῦ ἑτέρου),** and thus he compounded a nature

* Cp. Kant's contrast of the heteronomous, the diverse appetites and their satisfaction, with the autonomous, the unity produced by reason.

** Cp. Plato's contrast elsewhere of measure and more or less, also, the one and the dyad.

which was in a mean between the indivisible and the divisible and corporeal."[63] Aristotle in a similar way regards Callias or Socrates as each the union between "the same and the other" or "the indivisible and the divisible and corporeal" into one concrete individual. He accepts Plato's conception of a formula of the soul which is the basis of definition, though unlike Plato he does not attempt to state the formula. His quarrel with the Platonists is that it is unnecessary to assume a pre-existent independent pattern. The union between the same and the other is sufficient to account for the individual. The substance (*ousia*) or soul is always immanent in an individual. Phylogenetically it is immanent in the producing individual—the father. Ontogenetically, it is immanent in the individual history as its "peculiar form". It never exists apart. If Plato meant that the forms of things exist in the mind of God, the creative artist, he would not need to be troubled by Aristotle's objection. But Aristotle's God is not an artist and, therefore, Aristotle had no such ultimate locus for his forms. No doubt the emphasis in the Academy after Plato was on the self-subsistence of forms, and Plato has generally been so interpreted.

Another passage in the *Metaphysics* has generally been interpreted to mean that the substance of man is one and that individuals are differentiated by their bodies. This is the passage in which Aristotle argues that there is but one heaven. "For if there are many heavens as there are many men, the moving principles, of which each heaven will have one, will be one in species but in number many. But all things that are many in number have matter. (For one and the same formula applies to *many* things, e.g. the formula of man; but Socrates is *one*). But the primary essence has not matter; for it is complete reality. So the unmoveable first mover is one both in formula and in number; therefore also that which is moved always and continuously is one alone; therefore there is one heaven alone."[64] Aristotle in the preceding discussion has shown that it is necessary to assume that there are fifty-five different movers in order to account for the various movements of the spheres that have to do with the planets and the sun and the moon. But the move-

ments of the heaven of the fixed stars is for Aristotle uniform. If there were many heavens, each heaven must have its soul or mover, as in the case of the infra-heavenly bodies, and heaven would become a universal. When we have a plurality of individual movers, the form must be incarnate in matter as in man. But the primary essence to which heaven owes its motion is not a universal but is complete reality and in that respect comparable to Socrates who is *one*, rather than to man. The prime mover is complete reality par excellence for he has no matter, no potentiality. Therefore it is evident that the movement produced directly by the prime mover must be one and that there can be only one heaven. Ross' interpretation of the statement, "but Socrates is *one*" (as contrasted with man which is a universal) as meaning that "the *Logos* is common to all men, so that it must be matter which gives Socrates his uniqueness," shows the bias of a theory. Aristotle certainly could not have meant to say that it is the matter in Socrates which makes him *one*. He says definitely that "things in our perceptible world are one in virtue of soul, or a part of soul, or of something else that is reasonable enough; when these are not present, the thing is a plurality, and splits up into parts."[365]

Aristotle makes it clear again and again that substance (*ousia*) cannot be shared. He rejects universal being and unity as substances, since they would belong to more than one. "Nothing that is common is substance, for substance does not belong to anything but to itself and to that which it has, of which it is the substance. Further, that which is one cannot be in many places at the same time, but that which is common is present in many places at the same time; so that clearly no universal exists apart from individuals."[366] He criticizes the Platonists for saying that "the one over (*kata*) many is a Form." He charges the Platonists with holding "that there is one Form for many things whose form is evidently different (a conclusion which confronted the Pythagoreans also); and it is possible to make one thing the very Form itself of all, and to hold that the others are not Forms; but thus all things will be one. . . . Therefore to reduce all things thus to Forms and to eliminate

the matter is useless labour; for some things surely are a particular form in a particular matter, or particular things in a particular state.'"[67]

If the species, humanity, were the form of Socrates and Callias, the universal would be a cause and principle "in the fullest sense." But Aristotle tells us explicitly that "it seems impossible that any universal term should be the name of a substance. For firstly the substance of each thing is that which is peculiar to it, which does not belong to anything else; but the universal is common, since that is called universal which is such as to belong to more than one thing. Of which individual then will this be the substance? Either of all or of none. But it cannot be the substance of all; and if it is to be the substance of one, this one will be the others also; for things whose substance is one and whose essence is one are themselves also one.'"[68] If therefore humanity is the form of Socrates, Callias and all other human beings, they would all coalesce into one immense individual, for Aristotle's form is a whole-form. On the other hand, "if we are allowed to lay it down that a common predicate is a this and a single thing, Socrates will be several animals —himself and 'man' and 'animal', if each of these indicates a 'this' and a single thing.'"[69]

Aristotle is certainly clear that the soul is the primary substance and that souls are individual souls. The human individual is a composite being. He may be considered from the point of view of "the matter which is a this in appearance, . . . the nature which is a this or positive state towards which movement takes place, and, again, thirdly the particular substance which is composed of these two, e.g. Socrates or Callias."[70] The nature or form is not merely the end-term of the process but as the formula it must exist throughout the process, simultaneously with its effects to guide the process.[71] Genetically it is prior to the process, because it gives the process direction. But it persists through the process and gives wholeness to the process.

Matter could not be the basis of individuality, for matter has no individuality of its own. Fortunately we have a definite pronouncement by Aristotle on this point, though the commentators,

blinded by tradition, have been unable to see it. "Matter does not create a difference" between individual men, we are told in the ninth chapter of the tenth book of the *Metaphysics*. "For it (matter) does not make individual men forms of man, though the flesh and the bones of which this man and that man consist are diverse (heterogeneous). The concrete thing is diverse (*heteron*, consisting as it does of material parts) but not diverse (*heteron*) in form, because in the definition there is no contrariety. This is the ultimate indivisible.[72] Callias is definition + matter.'"[73] A thing is individual because it has one indivisible form, not because of its matter which is heterogeneous. Aristotle has already shown in chapter eight that different forms must have a contrariety in the definition; and this can be only if the individuals have an element in common, i.e. belong to one kind (*genos*). "That which is other in form is other than something in something, and this must belong to both."[74] Individuals may be of the same kind or belong to different kinds. But differentiation is always with reference to an essential property, not with reference to accidents, "whether conceived as matter or otherwise." A horse and a man are both animals, i.e. they have animality in common, "but this very animality must also be different for each (e.g. in the one case equinity, in the other humanity), and so this common nature is specifically different for each from what it is for the other. One then will be in virtue of its own nature one sort of animal, and the other another, e.g., one a horse and the other a man. This difference, then, must be an otherness of kind (*genos*). For I give the name of difference in kind (*genos*) to an otherness which makes the kind (*genos*) itself other.'"[75]

Forms then are differentiated within their kind. "All difference in form (*eidos*) is a difference from something *in something;* so that this is the same for both and is their kind (*genos*), horse or man.'"[76] (It is evident that Aristotle here uses *genos* for what the scholastics would call *infima species*. Aristotle is conforming to his own rule in the *Poetics* to use words in their common meaning so far as possible.) To be other in form means "to have contrariety, being in the same kind and being in-

divisible (and those things are the same in form which have no contrariety, being indivisible)."[77] We can see then why there can be no logical definition of an individual form. This is rather the limit of definition, the last differentia, which cannot be divided. "The substance of each thing and the essence of each . . . is the limit of knowledge; and of knowledge of the object also."[78] But we can distinguish one individual form from other individual forms, because here we can indicate their differences on the basis of the kind to which they belong.

Aristotle takes pains to show that no accidental qualities can be the basis of individuation. The accidental qualities are due to the incarnation of form in matter. In the *De Generatione Animalium* Aristotle maintains that difference in sex is not due to the form or soul of the individual but is an accidental characteristic, due to the varying resistance of matter to the formative soul. In chapter nine of book ten of the *Metaphysics,* Aristotle raises the question, "Why woman does not differ from man in form, when female and male are contrary and their difference is a contrariety."* Aristotle recognizes that the difference in sex "belongs to animal in virtue of its own nature and not as paleness or darkness does." He can easily dispose of variable accidental qualities such as paleness or darkness. They cannot be the basis of the differentiation of individuals. "For the same man can be, though not at the same time, pale and dark."[79] But male and female are constant contraries in the life of individuals. They are, however, not constant genetically. They emerge in the genetic process. "Male and female, while they are modifications peculiar to 'animal', are not so in virtue of its essence but in the matter, i.e., the body. This is why the same seed becomes female or male by being acted on in a certain way."[80] They are, therefore, accidental characteristics and not part of the essence of the individual. A soul cannot be said to be male or female.

Matter can have significance only as potency for individuality. It cannot establish individuality. Aristotle criticizes those who

* *Met.* Bk. X, 1058a, 29-31. It would certainly be silly to ask whether man and woman differ in species.

have used substance in such a loose sense as to call any material thing a substance, ignoring the whole-form. "Evidently even of the things that are thought to be substances, most are only potencies, e.g., the parts of animals (for none of them exist separately; and when they *are* separated, then they too exist, all of them, merely as matter) and earth and fire and air; for none of them is one, but they are like a heap before it is fused by heat and some one thing is made out of the bits."[81] Aristotle did not dream of a miraculously determinate matter which could furnish individuality. Matter must be fashioned by an immanent form in order to become an individual.

The misunderstandings of Aristotle's conception of substance are due, I think, to the fact that the commentators have taken their start from the scholastic terminology of the thirteenth century. But that is the worst possible cue. The scholastic mind worked in the opposite direction from the mind of Aristotle. The scholastic mind started with the Neoplatonic hierarchy from the more universal to the less universal, until it came to the *infima species*, the lowest universal in the descent, below which come the individuals, who have a doubtful status. The lowest human form for St. Thomas is the species, man. Individual men are individuated by their bodies. The species is prior to the individuals. The whole hierarchy of universals exists independently of the individuals at the bottom, even though, according to St. Thomas, our human mind is obliged to discover the universals by abstraction from individuals—not being able, as the angels are supposed to be, to see the universals in the mind of God. This is obviously an inversion of the situation as it existed in Aristotle's mind. For Aristotle the ultimately real is the individual. Only the individual is primary substance. Only the individual exists in the full sense. "Everything except primary substances is either predicated of primary substances, or is present in them, and if these last did not exist, it would be impossible for anything else to exist."[82] If we take Aristotle seriously when he repeats, again and again, that only individuals are ultimate substances, we have a sufficient key to the difficulties of his terminology.

It seems almost hopeless to get back to the terminology of Aristotle after centuries of interpretation. After Aristotle's death the Lyceum was influenced more and more by the formalism which had come to dominate the Academy after Plato. This classificatory formalism was taken over by Neoplatonism, transformed into a genetic scheme of universals, and as such dominated the Middle Ages. In the Latin development the scheme took on the stereotyped character of the Latin mind and the atmosphere of Latin theology. In scholastic philosophy the Greek "form" becomes a universal; *genos* and *eidos* become rigid terms signifying genus and species—genus signifying the universal above the species and *infima species* signifying the lowest universal, below which come individuals. The commentators on Aristotle, from the thirteenth century down to our own time, have been dominated by this terminology. This terminology, though not the emphasis, was suggested, no doubt, by Aristotle's *Categoriae* which through Porphyry had become the text-book of the Middle Ages. But Aristotle's language, in the *Metaphysics* at any rate, is not thus stereotyped. On the contrary, it is fluid and flexible. To a large degree he follows the ordinary literary usage which was familiar to cultured people. It is impossible to give a stereotyped definition of any of Aristotle's fundamental terms. One must be guided partly by his presuppositions, partly by the particular context. This is true especially of the term *genos*, which is usually translated genus, and the term *eidos*, which is translated species—both used in the scholastic sense. But such translations are misleading.

Aristotle did write a philosophical dictionary which has been included by the editors as Book V of the *Metaphysics*. But one must bear in mind that Aristotle here gives the current meanings of words, and not merely the meanings which he employs. Thus he gives four meanings of the word *genos*.[83] One meaning is that of race, signifying continuous generation of the same kind, as in the race of man. Another meaning is that of ancestral origin, as illustrated by the legend that the Hellenic race is descended from Hellen. The third meaning is the sense in which a "plane" is said to be the *genos* of plane figures and "solid"

of solid figures. A fourth meaning (which is only a more precise statement of the third) has reference to the first constituent element which is included in the "what" in definitions. Of this "what" the qualities are said to be differentiae. Only the third and fourth meanings have relevance to metaphysics. *Genos* here is entirely relative and means any universal or "matter" to which differentia are added. "*Genos* is an element in the thing's nature";[84] and differentiation is made possible by the fact that this element is common to the members involved, at whatever level the differentiation is made. *Genos* may mean what the Scholastics called *infima species* such as man or horse. In the proposition: Socrates is a man, man is the *genos*. The word, kind, has about the same vagueness in English.* The word *eidos* is often used in the popular sense of shape or form. This is the ultimate meaning in the *Metaphysics*. When Aristotle refers to the technical uses of the word *eidos*, he naturally has in mind the Platonists. "The term 'other in form *(eidos)*'," he tells us in Book V, 1018b, "is applied to things which in the same *genos* are not subordinate the one to the other, or which being in the same *genos* have a difference, or which have a contrariety in their substance." But there are not merely the derivative distinctions of class forms of which the Platonists spoke, but there are also the ultimate forms with their different definitions within such a kind *(genos)* as man or horse. Finally there are different attributes within the form of the individual substance itself.

Let us illustrate the point with a critical passage.[85] Aristotle has been concerned to show that there can be no essence of the hybrid, "white man". "'White man' is not precisely what some 'this' is, since thisness belongs only to substances. Therefore there is an essence only of those things whose formula is a definition. But we have a definition not where we have a word and a formula identical in meaning, . . . but where there is a formula of something primary." He here clearly refers to primary substance which cannot be used as a predicate of another.[86]

* Ross recognizes that in some cases to translate *genos* and *eidos* as genus and species makes nonsense. Note, 1058b.

It does not seem possible then that he should conclude the argument by saying (as Ross translates him): "Nothing then which is not species of a genus will have an essence." He must mean to say (using ordinary literary language): "Only individual forms within the kind will have essence", i.e. in the ultimate sense. For he is talking of primary substances; only they have *thisness* as he has just said. And he goes on to say: "This is evident that definition and essence in the primary and simple sense belong to substances" and that definition must mean "a particular kind of formula; and this condition is satisfied if it is a formula of something which is one."[87]

Aristotle is clear that *infima species* in the scholastic sense are not substances. "Man and horse and terms which are thus applied to individuals, but universally, are not substance but something composed of this particular formula and this particular matter treated as universal."[88] Species, in the sense of formal logic, Aristotle considers at most as a secondary substance.[89] Such an interpretation makes Aristotle cohere. I do not think that the charge is true that Aristotle confused *infima species* with individual substances. The charge is due to introducing a foreign terminology into Aristotle. But Aristotle was under no obligation to use the terminology of the Scholastics. It would be less misleading if the translators would use the Greek terms for Aristotle's fundamental concepts (instead of scholastic terms). Then the reader could judge for himself.

I do not believe that individuation was a problem for Aristotle. His argument, in regard to form, is with the Platonists. They assumed the reality of individual forms and Aristotle had no quarrel with them in regard to the multiplicity of individual forms. The differences which he emphasizes as against the Platonists are twofold. For Aristotle there can be no hierarchy of inclusion among substances. All substances are individual. There is a graded hierarchy of dignity of individual souls; and there is a hierarchy of classes of individuals. Class terms are universals. They are not ultimate substances but derivatives from substances and as such inhere in substances. They can have no independent existence. But the main quarrel with the Platonists is

in regard to the transcendence of forms. Plato held that form is impressed upon matter by the demiurge. God persuades matter to take on form for the most part but matter can never take on form perfectly. A certain cosmic laziness makes this impossible. The perfect forms exist only in the intelligible world which the world of process imitates. But the latter is an imperfect imitation at best. Aristotle insists that forms require no self-subsistent status. They are sufficiently accounted for by their immanence in individuals, whether in heredity or in art. But Aristotle too is dualistic and recognizes the world of necessity, the world of blind mechanical forces. He is on safe ground in regard to God, for in God is no matter, and in regard to the heavenly bodies, for their matter is simple and has no contrariety of qualities. But in the changing sensible world under the moon Aristotle too feels that form is not quite realized. And this gives the forms a certain transcendence which is difficult to explain on Aristotle's theory. What is immanence which is not quite immanent?

While this discrepancy does not seem to have been a problem for Aristotle, there are many problems about which he does worry. How can eternal forms be present in perishable things? "How will perishable things exist if their principles are to be destroyed? But if the principles are *imperishable,* why will things composed of some *imperishable* principles be perishable while those composed of the others are imperishable?"[90] Aristotle in one passage goes so far as to suggest that "perishableness is one of the attributes that belong of necessity to the things to which they belong. . . . Perishableness then must either be the essence or be present in the essence of each perishable thing."[91] Perishableness does not seem to be an accident for "what is accidental is capable of not being present." But it is difficult to see how perishableness could be part of an eternal essence.

Aristotle is brought up against the fact that forms or souls seem to perish. "But we must examine whether any form survives also afterwards. For in some cases there is nothing to prevent this, e.g. the soul may be of this sort—not all soul, but

the reason, for presumably it is impossible that all soul should survive.''[92] Aristotle only seems certain that the rational soul is eternal. He rejects transmigration of souls and therefore leaves no possibility for souls of perishable individuals to persist. If souls perish, they can also emerge. It would simplify Aristotle's problem a great deal if individual souls could emerge under the actuality of a fathering generation. Aristotle suggests this solution in *Metaphysics*, Book XII, 1071a, 11ff. "But the distinction of actuality and potentiality applies in another way to cases where the matter of cause and of effect is not the same, in some of which cases the form is not the same but different" —a passage already referred to. He suggests the alternatives that either the form must "be eternal or it must be destructible without being ever in course of being destroyed, and must have come to be without ever being in course of coming to be.''[93] But he dismisses the latter alternative since "it has been proved and explained elsewhere[94] that no one makes or generates the form, but it is the individual that is made, i.e. the complex of form and matter that is generated." There is a lacuna here in Aristotle's thought which his presuppositions made impossible for him to bridge consistently. What Aristotle needed was a creative mind in the universe, but Aristotle's God does not create. Here Plato had the advantage.

Aristotle is painfully conscious of the difficulty of definition in a world of individual substances. Substance is that which makes definition possible and only substance is definable, yet substance is subject and never predicate. All predicates are universal. Universals cannot be substances, "for everything that is common indicates not a 'this' but a 'such'." But if the first principles are "not universals but of the nature of individuals, they will not be knowable; for the knowledge of anything is universal.''[95] The difficulty is still greater if we assume that individuals are infinite in number. Since nothing can exist apart from individual things, if individuals are infinite in number, "how is it possible to get knowledge of the infinite individuals?''[96]

Aristotle tries to find a way round the difficulty by dis-

tinguishing between the substance and the matter of concrete individuals. He had come to the conclusion that the substance is the form, which we try to express in a formula. The form is the organizing relation, the wholeness. The whole is more than a juxtaposition of elements. "If we consider we find that the syllable is not produced by the letters + juxtaposition, nor is the house bricks + juxtaposition. . . . Nor is man animal + biped, but there must be something besides these, if these are matter,—something which is neither an element in the whole nor produced by an element, but is the substance; but this people eliminate and state only the matter. If then this is the cause of the thing's being, and if the cause of its being is its substance, they will not be stating the substance itself."[97] Aristotle thinks that if we recognize that concrete individuals are composite, consisting of form and matter, and if we eliminate the matter (with its contingent characteristics) which is unknowable, and if we identify the substance with the form, we can get around the difficulty of definition. For form is that which defines. But the ultimate form, which is the substance, is individual and has nothing in common with other forms. How then can we define it?

Aristotle says that we must state not merely the universal but the differentia and the differentia of the differentia, etc., until we come to the last differentia which will be "the substance of a thing and its definition."[98] We cannot get the unity of the thing by adding all the attributes of a thing. But if we start with the unity of the thing, we should be able to characterize it by its attributes. "Surely all the attributes in the defition must be one; for the definition is a single formula and a formula of substance, so that it must be the formula of some one thing; for substance means a 'one' and a 'this', as we maintain."[99] The matter of the concrete thing with its accidents does not enter into the definition. The concrete individual as such cannot be logically defined. "When we come to concrete things, . . . of these there is no definition, but they are known by the aid of intuitive thinking or of perception."[100] But has not Aristotle after all merely camouflaged the difficulty of definition by

his logical scheme? He does not tell us what the final differentia would be which would give the formula of the soul of the individual. I do not see how we can arrive at the individual through formal logic. We have seen that Aristotle admits elsewhere that substance is the limit of definition: "The substance of each thing and the essence of each . . . is the limit of knowledge; and of knowledge of the object also." (*Metaphysics,* 1058a, 17ff.) This is an implicit admission that there can be no definition of substance in the sense of formal logic. Aristotle admits elsewhere[101] that there are some eternal substances which are unique and cannot be defined, the sun for example. Is not the attempt to define the individual and unique a senseless paradox? If Aristotle was obliged to have recourse to another kind of knowing from logical knowing when he dealt with concrete individuals, namely intuitive reason, does not that hold of individual forms too? And can we completely separate the form from the matter? Aristotle himself recognizes that "the actuality or the formula is different when the matter is different."[102]

We need more than science if we are to become acquainted with the ultimate individuality of things. Science can reveal to us the aspects of nature. It can give us a conception of structure. But it cannot as science introduce us to individual reality; and ultimately reality is individual as Aristotle pointed out. To know the individual requires a different way of knowing from that of mere logic. It requires intuitive reason, as Aristotle says. It requires appreciation and communion. Purposive realization must include will and feeling, as well as ideas, and therefore real knowledge of purposive reality must include will and feeling as well as ideas.

CITATIONS IN CHAPTER 8

1. *Met.*, XIII, 3. Quoted by Gomperz.
2. Quoted by Zeller, *Aristotle*, Vol. II, pp. 24, 25.
3. *Met.*, 1069b, 6ff., W. D. Ross's translation which is used in the sequel for the most part.
4. *Aristotelianism*, J. L. Stocks, 1927, p. 51.
5. Quoted by B. A. G. Fuller, *Aristotle*, p. 88.
6. *De Generatione Animalium*, 783b, 23ff., translated by Arthur Platt.
7. *Ibid.*, 737a, 8ff.
8. *Ibid.*, 736b, 30ff.
9. *Ibid.*, 737a, 14f.
10. *Ibid.*, 736b, 28f.
11. *Ibid.*, 734a, 34ff.
12. *Ibid.*, 734a, 22ff.
13. *Ibid.*, 734a, 29ff.
14. *Ibid.*, 734b, 28f.
15. *Ibid.*, 735a, 2ff.
16. *Ibid.*, 734b, 34ff.
17. *Ibid.*, 778b, 1.
18. *Ibid.*, 778b, 15ff.
19. *Aristotle*, B. A. G. Fuller, p. 92.
20. *De An.*, III. 2, 425b, 22ff.
21. *De An.*, III, 3, 429a, 3ff.
22. *Hist. An.*, VIII. 1, 588a, 18, 588b, 4.
23. *De Anima*, II. 2, pp. 51, 52. Hammond's translation.
24. *Ibid.*, III. 5, Cp. the mortal soul of the *Timaeus*.
25. *Met.*, 1070a, 26.
26. *De An.*, II. 1, Sec. 12.
27. Quotations in this paragraph are from the *Nicomachean Ethics*, Bk. X, Ch. 8, Ross's translation.
28. Compare *Philippians*, Ch. 3, verses 11-14.
29. *Aristotle*, W. D. Ross, p. 28.
30. *Ibid.*, p. 80.
31. *Met.*, IX, 1046b, 4ff.
32. *Met.*, XII, 1063a, 10-20.
33. *Met.*, IV, 1010a, 30-35.
34. *De Anima*, II. 2, 414a, 14-16. For the meaning of *Energeia* see F. C. S. Schiller's *Humanism*, Ch. XII.
35. *Met.*, VII, 1038b, 33-34.
36. *Met.*, VII, 1037a, 25-30.
37. *Met.*, VII, 1031a.
38. *Met.*, VII, 1041a, 1041b.
39. *Met.*, 993a, 15ff.
40. *Met.*, XII, 1070b, 15.
41. *Met.*, VII, 1041b.
42. *Met.*, XII, 1071a, 21ff.
43. *Met.*, XII, 1071a, 11ff.
44. *Met.*, XII, 1071a, 13-14.
45. *Met.*, XII, 1071a, 35.
46. *Met.*, VII, 1037a, 5.
47. *Met.*, VII, 1035a, 15.
48. *De An.*, II. 2, 414a, 20ff. Hammond's translation.
49. *De An.*, II, 1, 413a, 2, 3.
50. *De An.*, III, 8, 431b, 1-2, J. A. Smith's trans.

51. *Met.*, 1075a, 5-10.
52. *De An.*, II, Ch. II, 414a, 12-14.
53. *Met.*, XII, 1071b, 4-20.
54. *Aristotle*, W. D. Ross, p. 80.
55. *Met.*, XII, 1072b, 25-29.
56. *Met.*, 1073a, 4-8.
57. *Met.*, XII, 1074b, 33-1075a, 6.
58. See *Nic. Eth.*, VII, 14.
59. *Met.*, XII, Ch. X, 11-19.
60. Macmillan, 1925.
61. *Met.*, VII, 1034a, 5ff.
62. *Op. Cit.*, 1034a, 5ff.
63. *Timaeus*, Section 35 (Jowett's translation). Cp. Sections 39-74 for the same use.
64. *Met.*, XII, 1074a, 29ff.
65. *Met.*, XIII, 1077a, 21ff.
66. *Met.*, VII, 1040b, 20ff.
67. *Met.*, VII, 1036b, 17ff.
68. *Met.*, VII, 1038b, 9ff.
69. *Met.*, III, 1003a, 10ff.
70. *Met.*, XII, 1070a, 9ff.
71. *Met.*, XII, 1070a, 22.
72. Ross adds kind, which shows his medieval bias.
73. *Met.*, X, 1058b, 6-10.
74. *Met.*, X, 1057b, 35.
75. *Met.*, X, 1058a, 1ff.
76. *Met.*, X, 1058a, 12, 13.
77. *Met.*, X, 1022a, 9.
78. *Met.*, X, 1058a, 17ff.
79. *Met.*, X, 1058b, 34, 35.
80. *Met.*, X, 1058b, 22-24.
81. *Met.*, VII, 1040b, 5ff.
82. *Categoriae*, 26, 4-6, E. M. Edghill's translation.
83. *Met.*, V, 1024a, 29 to 1024b, 9.
84. *Met.*, X, 1058a, 24.
85. *Met.*, VII, 1030a.
86. *Met.*, 1030a, 10.
87. *Met.*, 1030b, 5ff.
88. *Met.*, VII, 1035b, 28-30.
89. *Categoriae*, Ch. 5.
90. *Met.*, III, 1000b, 28f.
91. *Met.*, X, 1059a, 1-6.
92. *Met.*, XII, 1070a, 24f.
93. *Met.*, VIII, 1043b, 15ff.
94. Cp. VII, Ch. VIII.
95. *Met.*, III, 1003a, 10-15.
96. *Met.*, III, First part of Ch. IV.
97. *Met.*, VIII, 1043b, 5-14.
98. *Met.*, VII, 1038a, 19, 20.
99. *Met.*, VII, 1037b, 24ff.
100. *Met.*, VII, 1036a, 1-10.
101. *Met.*, VII, 1040a, 28-30.
102. *Met.*, VIII, 1043a, 11.



Chapter 9

CREATIVE EMANATION IN PLOTINUS

Plato and Plotinus

Plotinus is more of a poet than a philosopher; so we should not look to him for a consistent system, but we should be grateful for many brilliant suggestions. Plotinus is an eclectic. He appropriates what appeals to him not only in the various systems of philosophy of the Greco-Roman world but also in oriental mysticism, without thoroughly digesting what he has appropriated. He is a true child of Alexandria where East and West met. He regards himself as an orthodox Platonist; and he has certainly steeped himself in the dialogues of Plato. But much water has run under the bridge in the six centuries of history that separate Plato from Plotinus. Santayana says that Plato's philosophy is a setting for "the jewel of the Greek city state." There are other motives in Plato. But his two monumental dialogues, the *Republic* and the *Laws,* centre in the state and citizenship. The pattern of the state is laid up in heaven, and it is the vocation of man to realize this pattern with the least possible deviation. For both Plato and Aristotle, the good man is the good citizen. The individualism of Plotinus is in sharp contrast with this civic interest. He is concerned with individual salvation, not with political salvation. The ultimate vocation of man is to be "alone with the alone." Citizenship has ceased to be the end of life, in the Greek world, in the third century A.D. The only thing left is to save one's own soul.

Plato is fundamentally a rationalist, Plotinus a mystic. There has been considerable controversy as to whether Plato is to be regarded as a rationalist or a mystic. It is certain that Plato is not a mystic in the restricted sense. Plato's chief interest is in structure. He may be said to have discovered the concept of structure. He, at any rate, abstracted structure from the matrix of experience and made it an object of investigation. The fleeting world of perception must be interpreted through eternal

types. Since these types exist prior to the empirical individuals, they may be called archetypes. The type or essence gives meaning and worth to our passing world in which the type is reflected for a moment. The whole realm of types or essences is subordinated in the *Republic* to the Idea of the Good. The essences are to be understood as part of an objective teleological scheme. In other words, the structure of reality is ultimately the structure of value. The Idea of the Good is the ultimate structure of the universe. It makes the wholeness of things of which the philosopher is the lover. Its nature is orderliness, measure, harmony. From the point of view of structure, there can be no difference between the good and the beautiful. They both mean wholeness.

The pre-eminence of the Form of the Good is not that it is beyond structure, but that it is the structure par excellence. As the ultimate form of reality, it cannot itself be defined by discursive reason. We perceive it only through that which participates in it, as we perceive the sun through that which it illumines—its child. It is for discursive thought a limit, like the straight line in mathematics. Our positive consciousness of it is intuitive, not discursive. Beyond dialectic is contemplation. The quality of Beauty and Goodness must in the last analysis be creatively appreciated. But what we contemplate or appreciate is for Plato pure form, pure structure, it is not an indeterminate One. If we mean by mysticism that there is more to reality than discursive thought can define, then Plato is a mystic. He comes at length in his dialectic to a first principle which is indefinable, by discursive reason, because all valuation presupposes it. But so far from this first principle being above reason, it is the very structure of the rational world. The world of description derives its meaning from the world of worth. Plato's Idea of the Good and Plotinus' One are alike in lying beyond discursive thought. But this is an illusive similarity. There is in fact infinity between the conception of the Good as structure and the conception of it as a simplicity which has no structure.

For Plato real knowledge is gained through creative reason. It is through creative reason that we know the structure of

reality. Mind can know the meaning of things because it is akin to the creative intelligence in nature. God, who is higher than nature and higher than we, can be known only functionally through creative induction. Plato in the *Phaedo* warns us to be careful not to lose the eye of the soul by speculating about things we cannot know. He reiterates the warning in the *Laws*. The eye of the soul is creative intelligence. To know is to know the structure of nature. Plato is a poet, but he is not a mystic in the restricted sense in which the term is generally used. He recognizes the limitations of the human mind, but he does not claim "supernatural knowledge." In a poetic flight, he says in the *Phaedrus:* "Of heaven which is above the heavens what earthly power ever did or ever will sing worthily? There abides the very being with which true knowledge is concerned, the colourless, shapeless, intangible essence visible only to the mind who is pilot of the soul." But this is not mysticism. The structure of which he speaks *can* be known in a measure by creative intelligence. The Greeks did not mix philosophy with the Eleusinian mysteries.

If Plato introduced God as a philosophic principle, the Neoplatonists introduced mysticism as a philosophical method. For Plotinus there is a higher avenue of knowledge than reason. Plotinus does not seem to grasp Plato's distinction between discursive reason and creative reason. The latter fades into mysticism. "For the understanding . . . must possess itself of item after item; only so does it traverse all the field: but how can there be any such peregrination of that in which there is no variety? All the need is met by contact purely intellective. At the moment of touch there is no power whatever to make any affirmation; there is no leisure; reasoning upon the vision is for afterwards. We may know we have had the vision when the Soul has suddenly taken light. This light is from the Supreme and is the Supreme."* Plato would agree that discursive reason cannot grasp the nature of things. This must be done, in so far as we are

* Ennead V: 3, 17; *Plotinus*, translated by Stephen MacKenna, *The Medici Society*, 1917-1926, vol. IV, p. 43. In the citations I shall use E. for Ennead and M. for MacKenna. We are fortunate to have at last a standard translation in English by a scholar and a poet.

able, by creative reason. Only this can see reality steadily and see it whole. But we know when we are fully awake to the meaning of things, not when we go into a trance. Knowledge is not a passive but an active attitude. It is true that this creative insight is a knowledge of another quality from knowledge by common sense or even knowledge by scientific induction, based on statistical probability. It is based on intuition rather than generalization from particular instances. Genius has flashes of intuition which it proceeds to work out by logical methods. But intuition is the starting point, not the goal as in restricted mysticism. And the intuition of genius is not an abnormal state, but a healthy activity of a certain quality of mind. It is continuous with the more laborious methods of logical construction.

Mystical states are not *knowledge*. They are an *acquaintance* with reality under certain peculiar conditions. In this respect they are like sensory states. Seeing light is an ineffable state. It cannot be described in terms of anything else. In fact it cannot be described at all. But the sensation of light is a datum for knowledge. It is not knowledge. So mystical states are data for knowledge. They are not knowledge. They must be criticized and evaluated in terms of our waking reflective experience before they become part of knowledge. The Mediaeval Church recognized that some mystical experiences may be the work of the devil. The difficulty with mystical states is that they are not universal experiences like sensations of light. In the extreme form, which usually passes under that name, they are exceptional. The conditions for mystical experiences, unlike those for sensory experiences, are variable and unpredictable conditions. We therefore cannot refer to mystical states definitely in terms of the conditions. They are affective experiences and have the variability of affective experiences, and they are extreme instances of affective experience. Affective experiences, such as love and hate, furnish an acquaintance with reality. They colour reality. But they are not infallible. They must be criticized. It is a well known fact that it is difficult to examine affective experiences critically without changing them. We generally examine them retrospectively in memory which is at best an un-

certain method. Since mystical experiences are discontinuous with our prosaic waking life, the difficulty here is still greater. The result is that we interpret them in accordance with our prevailing bias. Since the mystics who have been philosophers have been as a rule biased in the favor of unity, they have interpreted their mystical states in that light. But Catholic mystics such as Saint Theresa have found verification for the trinity in mystical states. And one mystic, Mr. Blood, who was biased in favor of pluralism, brought back verification of pluralism to the delight of William James. We cannot appeal to moral dignity as a guaranty of mystical states. While mystics like Plotinus and the mediaeval mystics presupposed moral discipline for mystical states, others have induced mystical states by gazing at a bright button or by taking drugs. There is no way of establishing a qualitative hierarchy of mystical states, except by bringing them out into the clear light of reflection. When mystics have become garrulous, as many of them have been, they have usually talked either commonplaces or nonsense. Mysticism, as a way to truth, is a dubious way.

The imaginative content of mystical experience varies with the idiosyncrasies of the individual. Most mystics are naturally of the visual type, since that type is the most common. Mystical theology is largely a theology of light. God is conceived as light or the source of light. Hence the appeal of the metaphor of the sun. But sound is sometimes the medium. Then the mystical revelation takes the form of music and harmony. Touch may also be the medium, and the mystics speak frequently of contact with the divine. When taste is the medium, the revelation is one of sweetness. When the sense of smell furnishes the content, the experience is one of fragrance. In mediaeval mystics, especially nuns, the sexual element was often prominent and we have a vocabulary suggesting embrace and osculation. This form of experience was doubtless due to suppression which found a compensation in religious experience. The Church, on the whole, did not encourage mystical experience, for obvious reasons. Sometimes mystical experience is accompanied with visions or with objectified auditory experiences like the voices of Joan of

Arc. In St. Paul, on the way to Damascus, we have both visual and auditory objectification. And it is not uncommon for a number of sensory experiences to contribute.

While mystical states involve detachment from the world and dissociation of mental states, the sensory imagination nevertheless furnishes the content. The mystical state consists in the affective illumination or enhancement of the value of the experience. It gives a peculiar thrill to the content that is present. Obviously the mystical state itself does not guaranty the validity of the experience. This must be found in the correlation of the mystical experience with the rest of experience into a coherent view of reality. It must be tested, in short, like other experience. No doubt, in the case of the profound mystical experiences, it brings a new tone and meaning to the entire life of the individual. Whether mystical experience is acquaintance with divinity or devil must be tested by the fruits.

In speaking of Pythagoras' discovery of the numerical intervals of the musical scale by means of his monochord, Burnet says that henceforth Greek philosophy was dominated by the tuned string. Neoplatonism and Christian theology, which took its cue from Neoplatonism, was dominated by Plato's metaphor of the sun. In using this metaphor, the Neoplatonists and their imitators made it seem plausible by three mistakes. One was that the sun can perpetually radiate light without diminution of the supply. This seems so, within the limits of ordinary observation, but we know that the sun radiates out its substance and will eventually get dark or disappear into radiation. Another mistake was supposing light to be simple and therefore the source of light to be simple. We know that the sun is a highly complex body consisting of electronic matter in various stages of integration. Light and other radiant energies are emitted because of the agitation of matter; and the radiations are characteristic of the matter which emits them. White light, which is a combination of various wave lengths, is dissociated in a refracting medium and so we get the spectrum, as in the rainbow. Though white light seems simple, the multiplicity is all the time present. A third mistake is that light is supposed to be degraded in quality

the farther it departs from its source. We know that the quality, the wave length, is constant unless there is interference of some sort. It is merely the intensity which decreases—the quanta of light scattering with the square of the distance. These mistakes rob the analogy of its convincingness. And since the account of creation is based on the analogy, the bottom falls out of the argument. Because of the solar metaphor, it became necessary to give God a locus in the Empyrean beyond the astronomical hierarchy of the Ptolemaic system. God is still thought of as omnipresent by his influence but this becomes a feeble light in earth-born man and reaches the vanishing point in matter.

It is assumed in Neoplatonism that when the soul is "alone with the alone" in the state of mystical detachment, the soul is in union with the One, and upon this experience of the One the whole system is built. But how is the soul to know, when it is alone with the alone, that it is alone with God? It cannot reflect in this state. The reflection is an afterthought—an attempt to rationalize the experience into simplicity and unity. But may not the rationalization be mistaken? When the soul is alone, and there is no sense of duality or multiplicity, why assume that it has an experience of God? May it not be just enjoying itself? That was indeed the interpretation which the Sankhya philosophy put upon the mystical state. Hence this philosophy developed a pluralistic atheism with a multiplicity of souls. The soul reaches emancipation from matter, Prakriti, through various stages of enlightenment until it passes beyond self-consciousness and even consciousness—to be alone with itself. So far as the mystical experience is concerned, the pluralistic Sankhya interpretation is as much within its rights as the monistic interpretation by the Vedanta philosophy or by Neoplatonism. And the Sankhya is simpler, since it does not require the additional assumption of the One. At any rate it is a sufficient refutation of the assumption made by Plotinus that the mystical state is self-evidently an experience of God with which the soul is supposed to unite "when it is free from diversity." The fact of course is that the mystical experience is always used to verify the assumptions which the mystic has held in his

ordinary wakeful life and which come to have a particularly luminous and convincing quality in the mystic state. Plotinus had in his reflective moments arrived at unity and simplicity by abstracting from the content of experience, and in his mystical state he felt luminously what he had previously come to believe by reflection.

The Process of Creation

Let us now see how Plotinus derives the process of creation from his mystical God. Plotinus' God does not deliberately plan a world in its totality and details. In the *Timaeus,* Plato conceives of God as first creating a model of a world, which shall be the fairest and best, before he starts the executive work of creation; and, in the *Laws,* God is eternally executing a plan in its minutest details. The Gnostic and Christian writers, whom Plotinus criticizes, likewise think of God as executing a plan. According to Plotinus creation is a spontaneous, automatic process. God creates as the sun radiates light from its superabundance. "The causing principle, we might put it, reached the conclusion before all formal reasoning and not from any premises, not by sequence or plan but before either, since all of that order is later, all reason, demonstration, persuasion. Since there is a Source, all the created must spring from it and in accordance with it; and we are rightly told not to go seeking the causes impelling a Source to produce, especially when this is the perfectly sufficient Source and identical with the Term. A source which is Source and Term must be the All-Unity, complete in itself."[1] Of course to speak of planning from the mystical point of view is poetic license, since God is above Intelligence. Creation is unpremeditated. "Of that prior—since there is no obstacle, all being continuous within the realm of reality—there has suddenly appeared a sign, an image, whether given forth directly or through the ministry of soul or of some phase of soul, matters nothing for the moment."[2] But it really matters a great deal, since the Universal Soul and the particular souls are themselves part of the creation to be accounted for. To be sure, the process of creation is an eternal process and

therefore the Universal Soul and the particular souls always co-exist with the One, but this does not alter the relation of dependence which is all that creation means for Plotinus.

We must now try to ascertain the nature of the first principle from which everything radiates. This Plotinus sometimes calls the One and sometimes God. But Plotinus' God is not to be conceived as personality. Plotinus is not a theist like Plato. For Plato God is mind and since mind cannot exist without soul, God is mind in soul, in short personality. In the *Philebus,* Plato identifies the Good with God; and in the *Laws,* God is the only source of good. Plotinus objects to Plato's use of the Idea* of the Good and prefers to speak of the good. But for Plato the structure of the good is the character of God, while the One of Plotinus is structureless. It is above "being". According to the *Philebus* the good includes the beautiful and the true. It has the structure of beauty—measure, proportion, balance, symmetry. It is the true since truth must be validated in a teleological reality. Plotinus' One is sometimes characterized as the good, the beautiful and the true. But the characteristic which Plotinus emphasizes especially is simplicity. The One is indivisible—a unity more perfect than the monad, not to be compared with the most minute. "Its oneness must not be belittled to that of monad and point: for these the mind abstracts extension and numerical quantity and rests upon the very minutest possible, ending no doubt in the partless but still in something that began as a partible and is always lodged in something other than itself. The unity was never in any other and never belonged to the partible: nor is its impartibility that of extreme minuteness; on the contrary it is great beyond anything, great not in extension but in power, sizeless by its very greatness as even its immediate sequents are impartible not in mass but in might. We must therefore take the Unity as infinite, not in measureless extension or numerable quantity, but in fathomless depths of power. Think of the One as Mind or as

* Plato only uses the expression, the Idea of the Good, in the *Republic,* where he uses both the Idea of the Good and the Good. The Idea of the Good means in English the Form or Structure of the Good.

God, you think too meanly; use all the resources of understanding to conceive this Unity and, again, it is more authentically one than God, even though you reach for God's unity beyond the unity the most perfect you can conceive. For this is utterly a self-existent, with no concomitant whatever. This self-sufficing is the essence of its unity. Something there must be supremely adequate, autonomous, all-transcending, most utterly without need. Any manifold, anything beneath the Unity, is dependent . . . but unity cannot need itself; it stands unity accomplished."[3] The most important characteristic of the One is that It does not contain any difference. "Thus the Supreme as containing no otherness is ever present with us; we with it when we put otherness away. It is not that the Supreme reaches out to us seeking our communion: we reach towards the Supreme; it is we that become present. . . . We are ever before the Supreme—cut off is utter dissolution."[4] In His aloofness and self-sufficiency Plotinus' One is closer to Aristotle's God than Plato's. But Aristotle's God must be conceived as mind. And He does not create what is below Him in the scale.

If the ultimate characteristic of the One is that it is absolutely simple, it is difficult to see how it can be characterized as the good and the beautiful and the true. For all these terms imply structure. The good and the beautiful, according to Plato, imply measure, proportion, symmetry. But how can the absolutely simple possess these characteristics? These characteristics imply organization, and organization implies difference as well as unity. And what could the true mean if it were not, in some way, unity in difference? Unity above difference is a mere abstraction, neither good nor true nor beautiful. Plotinus feels difficulty about the beautiful. While he generally assumes that goodness and beauty are identical, he sometimes places beauty below the good. He does not subordinate beauty to the good because (like Santayana) he regards beauty as bound up with our sensuous nature. Plotinus means by beauty intellectual or formal beauty. When Plotinus places beauty below the good, he has in mind the way in which we recognize beauty. "The perception of Beauty and the awe and the stirring of passion towards it are for those

already in some degree knowing and awakened: but the Good, as possessed long since and setting up a natural tendency, is inherently present to even those asleep and brings them no wonder when some day they see it, since it is no occasional reminiscence but is always with them though in their drowse they are not aware of it: the love of Beauty on the contrary sets up pain when it appears, for those that have seen it must pursue. This love of Beauty then is later than the love of Good and comes with a more sophisticated understanding; hence we know that Beauty is a secondary: the more primal appetition, not patent to sense, our movement towards our good, gives witness that The Good is the earlier, the prior.''[6] But surely the notion, the full recognition, of the meaning of the good, is ''given only to the souls that are awake''; and the spontaneous feeling of beauty is as possible as that of the good. For Plato in the *Phaedrus* it is the appreciation of beauty which is the most spontaneous. But Plato held that we know most truly when we are most fully awake. To be sure the highest insight passes understanding, passes discursive reason. It is creative insight, but this comes to us only when we are most awake to the meaning of things.

We shall interpret Plotinus as an extreme creationist and not as an extreme preformationist, though the ambiguity of his language might lend colour to the latter interpretation. The lower emanates from the higher. It is not present in the higher. This point of view is at the opposite extreme from the materialistic theory of emergence which conceives the higher as emerging from the lower. Both are theories of emergence. They are concerned with the origination of something new which is not in the antecedents. But the two theories start from opposite extremes. The theory of emanation starts from the top, the theory of materialistic emergence starts from the bottom. In either case, the logical difficulties are the same. With Neoplatonism the problem is: How can reality as we know it, with its diversity and grades, emerge from the absolutely simple? Plotinus does not regard creation itself as a sin. In the mysticism of the Vedanta, a cloud passes over the clear vision of the

One; and Mayah, the world of illusion, rooted in ignorance and desire, comes into existence. Salvation means getting rid of the illusion of multiplicity, space and time. For Plotinus creation originates spontaneously from the pure unity of the One. Salvation is attained by rising above multiplicity into the simplicity of the One. But it is impossible to conceive how multiplicity could emanate from simplicity. We cannot say that multiplicity is present in the One for then the absolute simplicity disappears. Numenius, to whom Plotinus owes much, makes the horrible suggestion that "the One split from over-attention to its charges." Plotinus is not so crude as that. He suggests that the multiplicity is potentially present. But the One is pure actuality. There is according to Plotinus no contingency in the One. Potentiality is a legitimate category only when we read reality from below, from the imperfect to the perfect. It is not legitimate when we read from above, from the higher to the lower. It is just as impossible that diversity should emerge from abstract unity as that unity should emerge from abstract diversity. The logical difficulty is the same in either case, whatever emotional bias we may have for one or the other. Mysticism has the advantage over pure pluralism, for we do not expect mysticism to talk sense and therefore do not treat it critically.

Plotinus raises a smoke screen of paradoxes. "The One is all things and no one of them; the source of all things is not all things; all things are its possession—running back, so to speak, to it—or, more correctly, not yet so they will be. But the universe from an unbroken unity, in which there appears no diversity, not even duality? It is precisely because there is nothing within the One that all things are from it: in order that Being may be brought about the source must be no Being but Being's generator, in what is to be thought of as the primal act of generation."[6] But to say that everything can issue from the One, because the One is nothing, is mere nonsense. Another paradox, closely bound up with this, is that the One is nowhere and everywhere. Plotinus does not try to explain this, as Philo Judaeus and others did, by saying that God is present everywhere by his power and not by his essence. His theory did not permit

Plotinus to abstract the essence from the power. We shall later try to see what he means.

To make the emergence of variety from unity plausible, Plotinus like his admirer, Henri Bergson, has recourse to metaphors. He not merely adapts the metaphors of Plato to his use, but invents many others. He compares the One to an artesian fountain which breaks into multifarious spray. Of course the spring is not simple, and it requires matter—the resistance of the atmosphere and gravitational influence—to break into spray. But the One requires nothing. He compares the One to the sap of a tree which goes to nourish the many parts of the tree. But the sap is not really simple and the metaphor presupposes a pluralistic structure. He shows how shadows and echoes multiply one thing. But a pluralistic material constitution is presupposed, and the One presupposes nothing. The most convincing metaphor to Plotinus is no doubt that of the apparently simple light of the sun which, overflowing from the abundance of the sun, breaks into many rays. But neither the sun nor its radiation is simple, and it requires the resistance of matter to break up the light into its constituent rays. Of course one cannot expect perfect correspondence in metaphors, and yet they must not assume what is to be explained. The One of Plotinus is simple and it must produce variety spontaneously, without any aid from matter. He also uses the metaphor of the one science which produces a number of subordinate sciences, but the subordinate sciences are really contained in the one science. The many do not emerge from abstract unity.

The real key to Plotinus' conception of the derivation of the many from the One is probably to be found in the hierarchical scheme of classification which Aristotle elaborated from Plato. This scheme becomes in Plotinus not merely a logical hierarchy but also a generative hierarchy. For Plato the Good is the first principle in reality, as well as in thought, and everything must be subordinated to it. But for Plato the Good or God is the deliberate and direct creator of the whole scheme of nature. In Aristotle we have an imposing cosmological scheme with God at the top. But Aristotle's forms are not genetically related.

The higher does not generate the lower. Aristotle's God is not a creator. The Stoics had converted the forms into germinal reasons, creative agencies. Adopting the Stoic conception, Plotinus transforms Aristotle's hierarchy into a genetic scheme in which the higher generates the lower. Ammonius Saccas, we are told, had tried to reconcile Plato and Aristotle—the conception of creation and of formal implication. It is not an accident that the tree of Porphyry (who was a pupil of Plotinus), in Porphyry's version of Aristotle's logic (the text-book of the Middle Ages), became with the mediaeval realists a genetic scheme, in which the categories, from the most universal down through the various grades of universals are conceived as sustaining a generative relation—the more inclusive universals generating those below in the scheme and the First Principle generating all below it. The inspiration comes from Neoplatonism. Plotinus (or Ammonius Saccas) is the father of mediaeval realism.

With this background we seem to get some light on the problem of genesis in Plotinus. We must bear in mind that the genetic relation is an eternal relation. For Plotinus, as for Aristotle, the cosmos is eternal. The relation within the hierarchy, therefore, resolves itself into one of dependence. And logical dependence is identified with cosmological dependence. The One is the First Principle. "That Source, having no prior, cannot be contained: uncontained by any of those other forms of being, each held within the series of priors, it is orbed round all, but so as not to be pointed off to hold them part for part; it possesses but is not possessed. Holding all—though itself nowhere held—it is omnipresent, for where its presence failed something would elude its hold. At the same time, in the sense that it is nowhere held it is not present: thus it is both present and not present; not present as not being circumscribed by anything; yet, as being utterly unattached, not inhibited from presence at any point. That inhibition would mean that the First was determined by some other being; the later series, then, would be without part in the Supreme; God has his limit and is no longer self-governed but mastered by inferiors. While the contained must be where its container is, what is uncontained by

place is not debarred from any: for, imagine a place where it is not and evidently some other place retains it; at once it is contained, and there is an end of its placelessness.'" This sounds involved enough. But if we keep in mind that the universal is conceived as self-existent and independent of what is below it, and that what is below a universal is dependent upon it, and that the whole hierarchy of universals is dependent upon the First Principle and can exist only because of the presence of the First Principle, while the First Principle exists independently of all that is below it, the meaning becomes clear, even though not convincing.

All creation when viewed with reference to its source is degradation. This dogma is implied in Platonism. It became the dogma of Christian theology which took its cue from Neoplatonism. In Christian theology there arose, in the speculations of Alexandria, another conception of genesis, a genesis in kind. God gave birth eternally to the Son, "God of God, light of light, very God of very God, of one substance with the Father, begotten not made," as expressed in the creed of Athanasius* in 325 A.D. Later was added the idea of the Holy Ghost, "begotten of the Father and the Son." In mediaeval theology this idea of birth within the divinity, of genesis in kind, was sharply distinguished from creation, the genesis of the lower. Plotinus recognized only one kind of genesis, that of creation. With Aristotle the stars and spheres are nearest to divinity for they have bodies of ether which is pure and free from contrariety. Under the moon, matter plays a larger rôle. Here we have a hierarchy of souls. Man possesses a rational soul, as well as animal sensibility and the vegetative characteristics of nutrition and procreation. The animal kingdom comes next in the hierarchy with its sensitive soul and vegetative soul. The lowest soul is that of the plants, which have only the vegetative soul, with the properties of nutrition and reproduction. Below the vegetative stage is the inorganic which has form in a general way but no soul. This hierarchy is eternally fixed. It is not generated. For Plotin-

* The Nicene creed was the work primarily of Athanasius. The so-called Athanasian creed was much later.

us the degradation implied in the hierarchy is involved in the process of emanation itself. The metaphor of the sun is brought in to explain this degradation. Light is supposed to degenerate in quality, as it radiates farther from its source. The degradation was not, as for us, a degradation in the intensity of light merely. As a result of the metaphor of the sun, up and down in space was confused with up and down in the scale of value—a confusion already suggested by Aristotle with his absolute up and down. The degradation, involved in the internal necessity of emanation, while it gives rise to gradations of dignity, does not involve any moral blame. There is another kind of degradation which is due to matter, and this involves the problem of evil. Of this we shall speak later.

Plotinus' conception of the process of creation is (unconsciously probably) a sublimated Aristotelian scheme of classification conceived as cosmologically genetic. The forms or universals remain self-identical from the highest to the lowest, and yet they are present to all the forms below in the scheme. Hence the paradox of being present and not present. Since unity is at the top of the hierarchy for Plotinus, it is everywhere and nowhere. All the forms below it "are eternal; they spring from an eternal principle, which produces them not by its fragmentation but in virtue of its intact identity: therefore they too hold firm; so long as the sun shines, so long there will be light."[8] Plotinus passes easily from a formal abstraction to the metaphor of the sun. But the relation is really that of formal dependence. The form, which is above in the scheme, does not require those below it; but those below require it, and anthropomorphically are supposed to seek it, just as Aristotle's God is self-contained and indifferent to everything below him, but everything seeks him. For Plotinus the unity must be above all things but it must also "pervade all things and make all, but not be the universe which it makes."[9] Plotinus' abstract unity does not remain inert within itself, as an abstraction should. "Something besides a unity there must be or all would be indiscernibly buried, shapeless within that unbroken whole: none of the real beings (of the Intellectual Kosmos) would exist if

that unity remained at halt within itself.''[10] That would be a misfortune, but not so unintelligible as that a pure abstraction should generate anything. Plotinus lets the cat out of the bag when he comments on Plato's account of creation. He considers Plato's account as figurative. When Plato speaks of "coming into being by generation and creation: stage and sequence are transferred for clarity of exposition, to things whose being and definite form are eternal,[11] i.e., for Plotinus the relation is really a logical relation of universal and subdivisions, disguised as a genetic relation. He tells us himself plainly that emanation, in the sense of overflowing, is a metaphor.[12] It is as though Kant should have tried to generate the categories (also borrowed from Aristotelian logic) from the abstract unity of apperception. If Plotinus were really thorough he should transcend unity, the form of forms, and therefore an intellectual essence. There would then remain the pure quintessence of consciousness, bare awareness without any content. And this, as more radical mystics have pointed out, is more properly characterized as Nothing than as the One.

Let us now try to follow the process of creation as outlined by Plotinus. The solar metaphor gives a dynamic colour to the process. The One like the sun radiates or overflows from its infinite superabundance. Radiation suggests space and distance; and in this spatializing of creation Plotinus follows Plato and Aristotle. The spatial hierarchy is at the same time a hierarchy of value from the stars down to terrestrial matter. But with Plotinus the spatial hierarchy is merely a veiled form of logical implication from the first principle, the One, through the various degrees of dignity. Creation is not a process in time but an eternal relation of formal dependence. In this sense, "there is from the first principle to ultimate an outgoing in which unfailingly each principle retains its own seat while its offshoot takes another rank, a lower, though on the other hand every being is in identity with its prior as long as it holds that contact. . . . There exists, thus, a life, as it were, of huge extension, a total in which each several part differs from its next, all making a self-continuous whole under a law of discrimination by which the

various forms of things arise with no effacement of any prior in its secondary.''[18] The higher in the scheme generates the lower in the scheme and yet remains within itself and independent of the lower, as we should expect in a hierarchy of universals.

The suggestion of a dynamic relation from the higher to the lower is contrary to the Aristotelian conception. The dynamic relation is from the lower to the higher in the scale in Aristotle's cosmology, because it is the love of the lower for the higher which produces the teleological motion. When the relation is viewed as logical dependence, on the other hand, the generating movement is from the higher to the lower, not *vice versa,* while the implication of dependence is from the lower to the higher. If Plotinus had followed the order of implication suggested in his ''chain'', he should have begun with the lowest stage and worked his scheme backward. But Plotinus tried to combine Plato's conception of creation, from the Good down, with Aristotle's cosmological scheme, in which the First Principle, the absolute actuality, is indifferent in its self-absorbed isolation to what is below it. It is evident that the two conceptions are irreconcilable. The Good or God in Plato's cosmology is creative mind and bears a really dynamic relation to all below Him. He consciously originates the patterns and incarnates them into a world. He puts mind in soul and soul in body, while for Plotinus mind itself is part of the chain which is to be generated. And mind does not really, in the Platonic sense, create what is below it. It exists in its own actuality, like an Aristotelian God; and the world below—the World Soul with the stages it includes—reflects the patterns of mind or imitates mind. The chain of stages does not come into being. It is eternal, like a system of geometry (a figure suggested by Plotinus in another connection) or a system of Aristotelian classification (which it is).

In his conception of the process of generation, Plotinus combines two motives. There is the conception of a chain of forms from the One, the absolutely indeterminate, down to the individual forms, including at the bottom the forms of inorganic matter. In this chain all determination is negation. But Plato and Aristotle had established in their scheme the hierarchy of

mind, soul and body. The latter hierarchy is combined by Plotinus with his hierarchy of forms or essences. Plotinus gives priority to the hierarchy of essences. The First Principle first eternally generates the whole hierarchy of forms. Even the forms of inorganic matter are included in this generation. Matter has beauty because it has form. And the forms of matter exist yonder, in the eternal hierarchy of forms generated by the One. Now comes the problem of generating the Platonic and Aristotelian hierarchy of mind, soul and body from the formal hierarchy. While Plotinus follows Plato in having God generate all the seeds or forms, we must not forget that for Plato God is mind-in-soul and that the generation is a volitional act, while for Plotinus the forms follow from the mere presence of the First Principle, i.e. from formal dependence. Mind and soul must themselves be generated and are logically posterior to the scheme of forms. In contrast to Aristotle, for whom the hierarchy of forms must exist as incarnate in a hierarchy of individuals, Plotinus conceives the scheme of forms as prior to individuals and as generating the hierarchy of individuals.

How does Plotinus generate creative Intelligence or Mind from the scheme of essences? (MacKenna uses the term Intellectual-Principle for *Nous,* Dean Inge prefers the term Spirit, others prefer Intelligence or Mind or Reason.) We have seen that the scheme of essences is generated first. "Seeking nothing, possessing nothing, lacking nothing, the One is perfect and, in our metaphor, has overflowed, and its exuberance has produced the new:" i.e. Being or the scheme of essences. "This product has turned again to its begetter and been filled and has become its contemplator and so an Intellectual-Principle. That station towards the One (the fact the something exists in presence of the One) establishes Being; that vision directed upon the One establishes the Intellectual-Principle; standing towards the One to the end of vision, it is simultaneously Intellectual-Principle and Being; and, attaining resemblance in virtue of this vision, it repeats the act of the One in pouring forth a vast power."[18] Thus *mirabile dictu* emerges Mind or Intelligence by the scheme of essences becoming self-conscious. This emergence of essence

into self-consciousness is completed when essence turns towards its source, the First Principle, i.e. when it recognizes its derivative character. The emergence of Intelligence or Reason with its duality of object and subject, of essence and its self-contemplation, is the actualization of the first stage in the process of degradation. The metaphor of a ray of light or a sheaf of rays of light, turning automatically towards its source and becoming self-conscious, is not illuminating. Who ever saw a ray of light turning towards its source? Plotinus makes use of another metaphor. He says Intelligence in actualization is like the eye. There are two elements involved in the act of ocular vision: "there is the form perceptible to the sense and there is the medium by which the eye sees that form. This medium is itself perceptible to the eye, distinct from the form to be seen, but the cause of the seeing. . . . So it is with the act of vision in the Intellectual-Principle, this vision sees, by another light, the objects illuminated by the First Principle."[14] That seems more convincing, but unfortunately the emergence of the eye of Intelligence is the very problem he should explain.

Why the emanation of the lower from the higher should be called actualization is not clear at first glance. Aristotle would have said potentialization since the lower can be only potentiality with reference to the higher. But for Plotinus the procession of descent is a process of creation. The process of emanation from the higher to the lower is complete only when the lower turns towards its source. Thus the first stage of emanation is complete when the scheme of essences turns towards the One and becomes Intelligence. Since all the essences are in Intelligence we can deduce the structure of everything below Intelligence from the structure of Intelligence. "Fix on Intelligence your interior gaze. Then you will see the hearth of being where shines an unsleeping light. You will see therein how essences subsist simultaneously as divided and united."* This is another way of phrasing Plato's idea that it is through mind that we come to know the structure of things.

* E., VI. 2. 8; *Plotinus*, K. S. Guthrie, The Platonist Press, 1918, p. 904 (hereafter referred to as Guthrie).

Plotinus' deduction of self-consciousness from a scheme of essences may not seem convincing. But to those who are imbued with the Hegelian logic, it should not seem any more absurd than Hegel's attempt to generate self-consciousness from his dialectic of abstract categories, starting with the abstract concept of being and, in the course of the dialectic, arriving at individuality and individuality-contemplating-itself, i.e. the subject-object relation, which, finally is abrogated and absorbed in the Absolute Notion. We may perhaps compare the Absolute Notion to Plotinus' First Principle and think of Hegel as working the essences backward into the One. At any rate, a principle which transcends subject and object must transcend reflective thought. Hegel's Absolute becomes a mystical principle, as he himself seems at times to have recognized.[15] Hegel had the advantage of Plotinus in that in unfolding the Absolute he needed merely to unfold his own consciousness. He required no illumination from the Beyond.

Creation in Plotinus' system is from wave to wave or from stage to stage. No stage goes out beyond itself. On the contrary, it is indifferent to anything below it. It rests in itself, as you would expect independent universals to do, though a lower stage always points back to the higher stage from which it is derived. According to St. Thomas, on the contrary, God is the only creator. The subordinate, emanated beings do not create. The creative activity of God persists throughout, though it weakens with the distance and is only a feeble light in man. In matter it is completely spent.

While Intelligence is conceived to rest like the One within itself, the process of creation is not complete with Intelligence. Intelligence, Plato had shown, cannot exist without soul. For Plotinus, creation is dependence, and dependence is always from the lower to the higher. Intelligence is indifferent to what is below it, but it overflows, radiates, and the result is soul. The soul is dependent upon Intelligence for its significance and existence, not Intelligence upon soul. "This second outflow is a Form or Idea representing the Divine Intellect as the Divine Intellect represented its own prior, the One. This active power, sprung

from essence (from the Intellectual-Principle considered as Being), is Soul. Soul arises as the idea and act of the motionless Intellectual-Principle—which itself sprang from its own motionless prior."[16] When the soul turns towards its source, the Intellectual-Principle, the second stage of emanation is complete. The soul includes for Plotinus, as for Plato and Aristotle, the psychological powers below the active reason which furnishes the patterns or conscious purposes of conduct. The psychological processes of perception, memory and passive imagination can become purposeful only through the activity of reason and hence are dependent on it for their meaning and guidance. The gaze of the World Soul is directed towards Intelligence. From it she receives the patterns for her own creative process. "The World Soul, illuminated by Intelligence, illuminates and makes perfect the lower things as she can." She creates the world by using the intelligible essences as models (though of course automatically). Hence the world has form and beauty.

The World Soul, while turning to the stage above it and resting itself, in turn creates by overflowing. It enters in motion to beget an image of itself. "It takes fulness by looking to its source; but it generates its image by adopting another, a downward movement. This image of Soul is Sense and Nature, the vegetal principle. Nothing, however, is completely severed from its prior. Thus the human Soul appears to reach away as far down as to the vegetal order: in some sense it does since the life of growing things is within its province; but it is not present entire; when it has reached the vegetal order it is there in the sense that having moved thus far downwards it produces —by its outgoing and its tendency towards the less good—another hypostasis or form of being, just as its prior (the loftier phase of the Soul) is produced from the Intellectual-Principle which yet remains in untroubled self-possession."[17] While the World Soul is indifferent or impassive to the stages below her—the animal, plant and inorganic levels—these may be said to imitate or participate in her at nearer or farther remove. They imply or depend upon her; she does not depend upon them. She receives the forms from Intelligence. The created world

imitates these forms. The world of perception, therefore, does not reflect the forms but copies of the forms. "This world, therefore, is veritably a picture which pictures itself." The two first principles—Intelligence and the World Soul—are immobile. The third principle, the World, too is "immobile essentially, but, accidentally and in matter, having motion."[18]

The World Soul is the creator of all things in that they are all dependent upon her. They imply her in their hierarchy. Like speech, using Plato's figure, she is an image of Intelligence. "The heavenly system, moved now in endless motion by the soul that leads it in wisdom, has become a living and a blessed thing; the soul domiciled within, it takes worth where, before the soul, it was stark body—clay and water—or, rather, the blankness of Matter, the absence of Being, and, as an author says, 'the execration of the Gods.' "[19] But Plotinus warns us that we must not take the temporal language seriously. Our imagination pictures a beginning when the Soul first came "into commerce with bodily nature. It is reasonable, necessary even, to begin with the Soul of the All. Notice that if we are to explain and be clear, we are obliged to use such words as 'entry' and 'ensoulment', though never was this All unensouled, never did body subsist with Soul away, never was there Matter unelaborate; we separate the better to understand; there is nothing illegitimate in the verbal and mental sundering of things which must in fact be co-existent."[20] We must get rid of the illusion that anything in the universe is dead. "We cannot think of the universe as a soulless habitation, however vast and varied, a thing of materials easily told off, kind by kind—wood and stone and whatever else there be, all blending into a kosmos: It must be alert throughout, every member living by its own life, nothing that can have existence failing to exist within it. And here we have the solution of the problem, 'How an ensouled living form can include the soulless': for this account allows grades of living within the whole, grades to some of which we deny life only because they are not perceptibly self-moved: in the truth all of these have a hidden life."[21] This is a more explicit statement of the idea of Plato and Aristotle that the

universe is an organism. Plotinus becomes enthusiastic in his admiration of the beauty of the world. "Could a more beautiful image be imagined?" But we must remember that it is an image of the intelligible world, and is therefore inferior in reality to the world of essences which exist in Intelligence.

Matter, as we know it, is the lowest term in the scale of emanation. It is the limit of creation. "Thus the entire aggregate of existence springs from the divine world, in greater beauty There because There unmingled but mingled here. From the beginning to end all is gripped by the Forms of the Intellectual Realm: Matter itself is held by the Ideas of the elements and to these Ideas are added other Ideas and others again, so that it is hard to work down to crude Matter beneath all that sheathing of Idea. Indeed since Matter itself, is, in its degree, an Idea—the lowest—all this universe is Idea and there is nothing that is not Idea as the archetype was."[22] It is formed matter, therefore, of which he is speaking here. We shall have to consider the difficult problem of primitive matter later. The World Soul as an eternal or Divine Being remains pure in its integrity, firmly at rest in the Absolute—"yet, as we may put it, that huge illumination of the Supreme pouring outwards comes at last to the extreme bourne of its light and dwindles to darkness; this darkness, now lying there beneath, the soul sees and by seeing brings to shape; for in the law of things, this ultimate depth, neighbouring with soul, may not go void of whatsoever degree of that Reason-Principle it can absorb, the dimmed reason of reality at its faintest. . . . The kosmos is ensouled, not by soul belonging to it, but by one present to it; it is mastered not master; not possessor but possessed. The soul bears it up and it lies within, no fragment of it unsharing. The kosmos is like a net which takes all its life, as far as ever it stretches, from being wet in the water, and has no act of its own."[23] The soul is unbounded and embraces "the whole body of the All in the one extension; so far as the universe extends there soul is; and if the universe had no existence, the extent of soul would be the same; it is eternally what it is."[23] But there is a limitation. She could give the universe only "as much 'being' as it was able to receive."[24]

Creation and Salvation

Since the fundamental interest of Plotinus is the interest in salvation, for which the cosmological scheme is merely a frame, we must consider the relation of the scheme of salvation to the cosmological scheme. From the point of view of salvation the problem of matter and the problem of soul come to have a new significance. Since the latter problem involves the former, we shall first consider the former. Were Plotinus a thorough-going monist the problem of matter should present no special difficulty, aside from the system itself. According to the theory of emanation, creation is a perfect chain of logical and cosmological dependence. It is, to use his figure, like a system of geometry where every theorem implies its dependence upon those that precede it back to the first principles; and so the whole series of emanations points back to the starting-point. The First Principle is independent of the system, which is derived from it, though figuratively it radiates the system below it. This holds of each subsequent stage. Emanation, we have seen, is really a hierarchy of logical and cosmological dependence of the lower, in the procession, upon the higher. The system is in reality eternal, like a system of geometry. From the One emanate the essences, which exist actually in self-conscious Intelligence. From Intelligence, with its system of essences, radiates the World Soul which in turn radiates what is below it—human souls, animal souls, vegetative souls, until we come to the physical world with its forms, down to the forms of the elements. All of these forms—human souls, animal souls, vegetative souls, physical forms—are conceived as integrated into the World Soul and form one living whole, which, in turn, points to its origin in creative Intelligence.

But Plotinus is not a monist. With Plato and Aristotle he recognizes the existence of primitive matter. Primitive or formless matter is, from the point of view of emanation, the ultimate limit of degradation—the limit beyond the creative process. "Given that The Good is not the only existent thing, it is inevitable that, by the outgoing from it or, if the phrase be preferred, the continuous down-going or away-going from it, there

should be produced a Last, something after which nothing more can be produced: this will be Evil. As necessarily as there is something after the First, so necessarily there is a Last: this Last is Matter, the thing which has no residue of good in it: here is the necessity of Evil."[25] Thus "the last degree" is "non-being" or not-form. It is a limit beyond the series, since it "contains nothing more of the First." It is the opposite limit from the One, and arrived at, we are told, by abstracting from all form and quality. From the point of view of the logical chain of the categories, it would be non-entity, i.e. it has no essence whatever. There is no reason, however, why we should give to non-entity the opprobrious name of "evil." But Plotinus is not a monist. There are other considerations beside logical considerations in his system. There are the ethical and religious considerations; and they are the most vital part. The rest is frame-work and very doubtful frame-work. The great problem is salvation.

From the practical and religious point of view, matter is not a mere logical limit. It takes on positive significance. We must be careful at the outset to distinguish primitive matter from formed matter. Matter as we perceive it is already formed matter, as Plato and Aristotle had made clear. In the world as created, matter does not exist in isolation. It has taken on form to a certain degree. The four elements—earth, water, air and fire—are not primal matter. They have been formed. But we have here arrived at the jumping-off place: "The more corporeal a thing is the more it approaches non-entity, returning to unity with the greater difficulty."[26] Plotinus' conception of primal matter is eclectic and not easy to grasp. It is, of course, difficult to define the absence of form. Primal matter is incorporeal, eternal, infinite (i.e. without limit or measure) and impassive. It is like a mirror which reflects everything and receives nothing. Sense objects are appearances like the reflections in a mirror or like echoes and shadows. Primal matter is not characterized by quality or quantity. These are due to form and are possessed only by organized matter. Primal matter is the medium of generation, but it contributes nothing. It is sterile. Only form is

creative and primal matter has no form. Primal matter cannot exist *within* Intelligence, for Intelligence is the seat of pure forms. But yet we require it to account for the world of process. With Plato's *Timaeus,* Plotinus speaks of matter as the mother and nurse of generation. He interprets Plato correctly as meaning that the matrix of primitive matter in space is the nurse of generation. Following Aristotle, Plotinus also speaks of matter as the substrate of change. There can be change from one set of qualities to another only through the medium of matter. Since primitive matter is void of form, it is, from the point of view of creation, absolute indigence. Since beauty and goodness imply form, matter is, in contrast with them, absolute ugliness, absolute evil (in the metaphysical sense). This does not mean moral evil which implies volition. Primitive matter has no psychological qualities and therefore is incapable of moral evil.

While matter is non-being, as contrasted with form which is being, yet it enters into the composition of things. Like Plato, Plotinus holds that "the world was created by a concurrence of Intelligence and necessity." Primal matter is morally neutral, since it has no will, but it is not metaphysically neutral. Primal matter is required to account for the accidents, the contingent qualities of things. In this respect Plotinus follows Aristotle. "The difference between a Roman nose and a snub nose is derived from matter."[27] The accidents, the peculiar characteristics of concrete things, are emergents in the strict sense. They do not emanate from the cosmological scheme: "Compounds—as owing existence to hazard and not to the Intellectual-Principle, having been fused into objects of sense by their own impulse—are not to be included under Ideas."[28] As with Aristotle, matter is made responsible for the malformations in the world of process. All the ugliness and monstrosities are due to it: "On the question as to whether the repulsive and the products of putridity have also their Idea—whether there is an Idea of filth and mud —it is to be observed that all that the Intellectual-Principle derived from the First is of the noblest, in those Ideas the base is not included: these repulsive things point not to the Intellectual-Principle but to the Soul which, drawing upon the In-

tellectual-Principle, takes from matter certain other things, and among them these."[29] If primitive matter is the mirror which reflects the forms and so gives us the world of appearances, it is not a neutral mirror. It has a character of its own which distorts the forms. It is a refractory element in the formative process. Being formless, it is absolute ugliness, deformity. "We may even say that Beauty is the Authentic-Existent and Ugliness is the Principle contrary to Existence; and the Ugly is also the primal evil; therefore its contrary is at once good and beautiful, or is Good and Beauty: and hence the one method will discover to us Beauty-Good and the Ugliness-Evil."[30]

There are, I have pointed out, two kinds of degradation in Plotinus' cosmology. There is the degradation which is due to the very nature of emanation, in that the emanated is always lower in dignity than that from which it is derived. To this degradation no blame attaches. But there is another kind of degradation which is due to primal matter. Here we have materialistic emergence, not emanation. The struggle of form with matter is responsible for the failure, in the world process. It brings about the deformity, the ugliness, in short the evil that we find. Primal matter does not exist as separate, but neither is it assimilated to the higher. It is the abyss toward which the soul gravitates when it becomes detached from its source. What the world "receives from divinity are goods; its evils derive from primordial nature."

Under the influence of Aristotle, Plotinus at times recognizes that formed matter plays an important part in the economy of nature. Formed matter, in the shape of the organic body, is necessary to the soul's realizing its capacities which otherwise would be dormant. The body is the instrument of the soul in this existence. But we must be careful to note that this is formed matter. Primal matter has no potentiality. Dean Inge, who is anxious to put the most favourable interpretation upon Plotinus, emphasizes the potential aspect of matter—an aspect which plays so large a rôle in Aristotle's philosophy. According to Dean Inge, Plotinus "is careful to point out that though matter in itself would be evil, if it could exist by itself, yet matter

as we know it has the promise of good. It is 'potentially all things'; its being consists in what it may become. It is the necessary condition of all good, in so far as good is a progress from potentiality (*dunamis*) to actuality (*energeia*). There can be no cosmos without form working on matter. . . . Matter in this sense is an essential factor in every process, since all things endeavor to rise in the scale of being. Matter is that without which no effort would be necessary or possible."[31] No doubt there is this Aristotelian influence in Plotinus which he carried away from his teacher, Ammonius Saccas, and which was probably kept alive by Amelius, for some time the pupil and secretary of Plotinus. But we must keep in mind that it is formed matter to which Plotinus pays tribute.

Primal matter has nothing potential in it. It is impassive and retains its primitive character even in the composition of formed matter. "Must not the nature of this Undetermined be annulled by the entry of Determination, especially where (as in Matter) this is no attribute (but the very nature of the recipient)? . . . No: its evil is in its first lack: it was not a possessor. To lack one thing and to possess another, in something like equal proportions, is to hold a middle state of good and evil: but whatsoever (like this substratum) possesses nothing and so is in destitution—and especially what is essentially destitution—must be evil in its own kind. For in Matter we have no mere absence of means or of strength; it is utter destitution—of sense, of virtue, of beauty, of pattern, of Ideal principle, of quality. This is surely ugliness, utter disgracefulness, unredeemed evil."[32] The dualism of form and matter becomes a dualism of good and evil. And this dualism is absolute. Primal matter retains its own evil character even when it becomes an ingredient in the concrete world. It gets credit for the failure, the miscarriage, the ugliness in process, rather than its potentiality, which is due to form.

Monism is fashionable at present. Hence the attempt of writers like Dean Inge to prove that his favorite philosophers, Plato and Plotinus, must really have meant to be monists. But neither in the cosmology of Plato nor of Plotinus does God

create primal matter, as He does in the theology of Christian writers, like Origen and St. Augustine. Such a mode of thinking was as foreign as it would have been repugnant to Plato, Aristotle and Plotinus. Dualism was for them a necessary outcome of their ethical view of God. Since God was conceived as absolutely good, they required something beside the formative agency in the world to account for the failure of form, the problem of evil. Plotinus, indeed, degrades matter further than Plato. For Plato, as for Plotinus, primal matter is the formless, the indeterminate—the world of chance and contingency when viewed with reference to the teleological order, with which the blind necessity of primitive matter combines in the world of process. But primal matter for him is not evil. It is the raw material which can be fashioned "for the most part," into the forms of nature and thus contributes depth or solidity to nature. For Plotinus primal matter is absolutely evil and remains so in the composition of nature, in spite of the utility and beauty of formed matter. Plotinus' dualism has the oriental tinge. There has been a great change in the intellectual climate from Plato to Plotinus. Plato's God, like an architect works with matter to fashion the fairest world possible. Plotinus, like Philo Judaeus, must keep God entirely separate from matter. God must not be contaminated by contact with matter. The human soul, to its misfortune, sometimes becomes entangled in matter. Matter sticks like mud to the wings of the soul and holds it earth-bound. Plotinus not only despises primal matter, but he despises the world of sense, in spite of occasional tributes to its beauty. He despised his body and would not, according to Porphyry, tell the place of his birth or the name of his parents. In this he is thoroughly unGreek. The Greeks admired and cherished the body and gave matchless expression to physical as well as spiritual beauty. There is indeed the pessimistic Pythagorean note in the first part of the *Phaedo*, and a suggestion of it in the *Phaedrus*. But it passes over and is no part of the main theme. The note of other-worldliness is as foreign to Greek civilization as it is germane to early and mediaeval Christianity with its oriental strain.

But what about the significance of the human soul? There can be no doubt that the cosmological architecture of Plotinus is erected for ethical and religious reasons. At the same time it is clear that it will not serve the purpose. According to the emanation theory human souls should emanate from the World Soul and be inferior to it. The World Soul should sustain, in relation to human souls, the rôle of the universal to its particulars. Plotinus does ponder the problem in that way. "How then can a multitude of essential beings be really one? Obviously either the one essence will be entire in all, or the many will arise from a one which remains unaltered and yet includes the one-many in virtue of giving itself, without self-abandonment, to its own multiplication. It is competent thus to give and remain, because while it penetrates all things it can never itself be sundered: this is an identity in variety."[38] He suggests the analogy of a perfect deductive science where every part implies the whole. "We may think of a science with its constituents standing as one total, the source of all those various elements." But even more suggestive is the analogy of the seed. "Again, there is the seed, a whole, producing those new parts in which it comes to its division, each of the new growths is a whole while the whole remains undiminished: only the material element is under the mode of part and all, the multiplicity remains an entire identity still."[38] This conception has lately been maintained by Driesch, who held at one time that every part of the germ cell is equipotential, i.e. can give rise to a whole organism. Plotinus suggests that difference in bodily accidents might serve to differentiate individuals—a suggestion he derived mistakenly from Aristotle. But Plotinus does not follow up this suggestion.

One wonders why Plotinus deems it necessary to account for the plurality of souls but ignores the plurality of intelligences. According to Plato, the Creator furnished the immortal seeds of men, while leaving to his ministers to put mind in soul and soul in body. Aristotle assumes that rational souls have an independent existence prior to and after the history of the biological individual and that, at some stage of the process, a rational

soul enters from the larger cosmos. But he does not attempt to show the relation of human rational souls to the supreme Reason. According to the theory of emanation, human souls must emanate below the level of Mind or Intelligence. Plotinus definitely states that human beings are inferior to the stars. "The beings which possess a nature inferior to the star Souls, that is men, occupy the second rank in the universe, and play in it the same part played in us by the second power of the soul." He allows, however, that when human souls are virtuous they may co-exist with the World Soul and rule the world with it. Such coordination does not seem consistent with the scheme of emanation. But even if they were coordinate with the World Soul, they could only receive the patterns from Intelligence; they could not have the quality of Intelligence.

As against the upholders of materialistic emergence who make the soul a function of the body, Plotinus maintains the independence of the soul, while existing with its body. He criticizes Aristotle's theory of entelechy as he understands it. Aristotle maintains the separability of the rational soul only. All other souls are bound up with their bodies. They are merely the forms of the bodies. For Plotinus the whole soul in its integrity is independent of the body. This follows from the transmigration of souls which he assumes. According to his theory of metempsychosis the souls of animals and plants are degenerate human souls, and must therefore have come from without.

Plotinus makes some keen suggestions about the relation of the soul to the body. The soul generates a suitable body, not the body the soul. He definitely rejects materialistic emergence which he attributes to Stoicism. Materialism cannot account for the unity of the soul. The relation is that of emanation, not materialistic emergence. We should say that the body is in the soul, i.e. is contained in the soul, not that the soul is in the body. The body is the degradation of soul. It does not account for memory, but it accounts for oblivescence (an idea adopted and elaborated by Bergson). While Plotinus maintains with Aristotle that soul and body form one living whole, yet the soul can in a measure be independent of its body: "From the Soul

using the body as an instrument, it does not follow that the Soul must share the body's experiences: a man does not himself feel all the experiences of the tools with which he is working."[34] The soul is in the body in the sense that it is present to the body. But it is not an effect. It is present as "Ideal-Form in Matter." But it is not merely the form of the body. It is a self-existent spiritual entity which actualizes the body. The soul makes its own body and survives its body. It is eternal. It makes use of the ministrations of the body; yet though the soul suffuses the body it may be a stranger to the body's passions.

Plotinus is careful to distinguish between the relation of the Universal Soul to its body and the relation of the human soul to its body. "We must recognize how different is the governance exercized by the All-Soul: it is not in fetters. . . . The Soul of the Universe cannot be in bond to what itself has bound, it is sovereign and therefore immune of the lower things, over which we on the contrary are not masters. That in it which is directed to the Divine and Transcendent is ever unmingled, knows no encumbering; that in it which imparts life to the body admits nothing bodily to itself." The Universal Soul has its own independent life and is not affected by the material inset, but sets the conditions for it. "Thus a graft will die if the stock dies, but the stock will live on by its proper life though the graft wither."[35] The universal fire is unaffected by the going out of the fire in us. The Universal Soul turns to its origin and remains fixed in its station, indifferent to what is below. On the theory of emanation, one wonders why there should be this difference. If the human soul emanates its body, why should it not turn automatically to its source and remain in itself, indifferent to what is below it, as does the World Soul? The reason is plain enough. The World Soul cannot sin because it is an abstract form. It has no will and therefore cannot fall into the error of desiring what is below it.

It is plain that the human soul, when we view it psychologically, ethically and religiously, cannot be regarded as a mere emanation from a Universal Soul, which is an abstraction. The

human soul is below Intelligence and the World Soul in the hierarchical scheme of emanation. But not so in the ethical scheme. Here, on the contrary, she reaches, in her capacities and her activities, the whole way, through all the levels. The human soul is present in the three spheres—the divine, the middle, and this mundane sphere. "It is one nature in graded powers; and sometimes the soul in its entirety is borne along by the loftiest in itself and in the Authentic Existent; sometimes, the less noble part is dragged down and drags the mid-soul with it, though the law is that the Soul may never succumb entire."[36] Yes, more than that: in her highest moments she may, according to Plotinus, rise beyond the intelligible world to union with the One—an experience which is impossible to the World Soul, the celestial intelligences, or even the Universal Intelligence. They remain forever subordinate levels. Of course the cosmological levels themselves are abstractions from the levels of human experience. And the human soul is more than levels. It is a living personality with a will which should be directed to the higher, but is often alas! directed to the lower—the animal and vegetative interests of human nature.

Human souls exist eternally. The process of emanation is an eternal process. It is a relation of dependence, not of origin in time. We need not then account for the creation of human souls. "Without any inherent contradiction it may therefore be asserted either, that the souls are sowed into generation, that they descend here below for the perfection of the universe, or that they are shut up in a cavern as the result of divine punishment, that their fall is simultaneously an effect of their will and of necessity—as necessity does not exclude voluntariness—and that they are in evil as long as they are incarnate in bodies."[37] The real transactions are eternal transactions. The temporal sequence is our reading of the events. The fall of the soul from its high estate must be understood as such an eternal act. It cannot be understood in terms of the category of cause and effect. The soul is created eternally to be with God and to enjoy God. God has communicated only good to the soul.

Why do souls fall from their high estate? This has nothing

to do with emanation. The fall has its root in the will. Plotinus gives his own version of the fall which agrees in spirit with the *Bible* and with Milton: "What can it be that has brought the souls to forget the father, God, and, though members of the Divine and entirely of that world, to ignore at once themselves and It? The evil that has overtaken them has its source in self-will, in the entry into the sphere of process, and in the primal differentiation with the desire for self-ownership. They conceived a pleasure in this freedom and largely indulged their own motion; thus they were hurried down the wrong path, and in the end, drifting further and further and further, they came to lose even the thought of their origin in the Divine."[38] They are like children who have been separated from their family since their birth and do not know their own parents. The evil lies, as St. Augustine pointed out, not in the existence of the lower, but in desiring the lower. The animal, vegetative and inorganic levels are not evil. They are even beautiful in themselves. But for a human soul to want to live as an animal is evil. Why did this perverse desire arise in pure souls? This must be a mystery for any theory which starts with an absolute state of purity. Plotinus points out with much beauty that evil is failure of adjustment—failure to keep step with the divine rhythm. "The natural movement within the plan will be injurious to anything whose natural tendency it opposes."[39] Those who do not comply with the larger order are destroyed. The universal order is compared to a celestial choral ballet. "A great choral is moving to its concerted plan."[39] "In this choiring, the soul looks upon the wellspring of Life, wellspring also of Intellect, beginning of Being, fount of Good, root of Soul."[40] Plotinus speaks sometimes as though a descent into the body at all were evil, but he admits that souls may be sent below as messengers for special service. Then the descent is not evil. In any case, if the soul does not stay long below and does not get attached to what is below, she may even profit by the adventure. While he counsels the soul to fly from the world, in an inspired moment he says, "we should not leave the earth, but not be of it," suggesting the Fourth Gospel.

But how shall we fly to the Fatherland? "You must close the eyes and call instead upon another vision which is to be waked within you, a vision, the birthright of all, which few turn to use."[41] To rise to the highest vision requires thorough-going moral preparation. "You must contemplate noble deeds, then beautiful works wrought by the good, lastly search the souls that have shaped beautiful forms, until you are self-gathered in the purity of your being, nothing from without clinging to the authentic man. . . . Therefore, first let each become godlike and each beautiful who cares to see God and Beauty. So, mounting, the soul will come first to the Intellectual-Principle and survey all the beautiful Ideas in the Supreme and will avow that this is Beauty, that the Ideas are Beauty. For by their efficacy comes all Beauty else, by the offspring and essence of the Intellectual-Being. What is beyond the Intellectual-Principle we affirm to be the nature of Good radiating Beauty before it. So that, treating the Intellectual-Kosmos as one, the first is the Beautiful: if we make distinction there, the Realm of Ideas constitutes the Beauty of the Intellectual Sphere; and the Good, which lies beyond, is the Fountain at once and Principle of Beauty: the Primal Good and the Primal Beauty have the one dwelling-place and, thus, always, Beauty's seat is There."[42]

To be assimilated to God is for Plotinus as for Plato the ultimate goal of the soul. "Thus in her ascension towards divinity, the soul advances until having risen above everything that is foreign to her, she alone with Him who is alone, beholds, in all His simplicity and purity, Him . . . from whom everything draws its existence, life and thought. He who beholds Him is overwhelmed with love; with ardor, desiring to unite himself with Him, entranced with ecstacy. . . . What beauty could one still wish to see after having arrived at vision of Him who gives perfection to all beings, though Himself remains unmoved, without receiving anything; after finding rest in this contemplation, and enjoying it by becoming assimilated to Him? Being supreme beauty, and the first beauty, He beautifies those who love Him, and thereby they become worthy of love. This is the great, the supreme goal of souls; . . . to succeed in contemplating beauty

face to face.''[43] And the real misfortune is to be excluded from this beauty. ''Real misfortune is not to lack beautiful colours, nor beautiful bodies, nor power, nor domination, nor royalty. It is quite sufficient to see oneself excluded from no more than the possession of beauty.'' Such possession is precious enough to render of no account all natural beauty. Plotinus develops the theme of the *Symposium* and the *Phaedrus* with marvelous variations.

Since Plotinus' God is indifferent to what is below Him, no prayers in the ordinary sense can be offered to Him. But prayer in the sense of attunement is possible. ''Neither the sun, nor any other star hears the prayers addressed to it. If they are granted, it is only by the sympathy felt by each part of the universe for every other; just as all parts of a cord are caused to vibrate by excitation of any one part; or just as causing one string of a lyre to vibrate would cause all the others to vibrate in unison, because they all belong to one system of harmony. If sympathy can go as far as making one lyre respond to the harmonies of another, so much the more must this sympathy be the law of the universe, where reigns one single harmony, although its register contains contraries, as well as similar and analogous parts.''[44]

It is evident that there are two motives in Plotinus' conception of reality. There is the motive of structure which finds its expression in the emanation theory with its hierarchy of forms —with unity, the final abstraction, at the apex of the pyramid and the multiplicity of individual forms at the base, physical forms being the lowest level. This structural hierarchy is conceived as genetic: the higher in the scale emanates the lower or, in logical language, the lower is dependent on the higher. The absolute low limit in the scale of degradation is non-being which, in contrast with the world of being or essence, is nonentity. The structural conception is deterministic. Each stage or level is formally dependent upon the level above it—the more inclusive universal which contains it. There is no failure, sin or error in the procession of emanation, though there is necessary degradation.

But Plotinus is ultimately interested in the salvation of the human soul. From the point of view of this interest, it is impossible to consider the human soul as a mere category or form, derived from the World Soul and inferior to it, and thus two levels removed from the One. The human personality must have the capacity to reach to the One, if it is to commune with the One. Furthermore, from the point of view of salvation, the One cannot be a mere category of the greatest generality or simplicity. It must be a perfect life. The structural hierarchy, it is true, is eternal in the nature of reality. But it does not exhaust the meaning of reality. The individual human soul is not a mere form, but a will. It is not bound by logical necessity to any one level in the cosmological scheme. It may choose any level as its own. It may appear at the vegetative, animal, psychological, rational, or even the divine level. As a matter of fact it rarely appears at the divine level of absorption into the One, less rarely at the level of creative Intelligence, more often at the pragmatic psychological level, and frequently sinks to the animal and even the vegetative levels. You cannot predict from the structural scheme where the human soul may appear, since this depends on a contingent factor—the will—, though you can say that it must appear in one of the structural levels. Its salvation lies in passing from a lower level to a higher. Its damnation lies in falling to a lower level.

There appears then in Plotinus the antinomy of structure, with its implication of logical determinism, on the one hand, and of individuality and the contingency of will, on the other hand. Plotinus is not conscious of the antinomy. Both aspects are needed and he accepts them both. The conception of emanation satisfies him intellectually and aesthetically. This conception, we have seen, amounts logically to the formal dependence of the less inclusive universals upon the more inclusive universal in the scheme of classification. This dependence becomes for Plotinus, who is obsessed with the metaphor of the sun, a relation of generation. But while the conception of formal emanation satisfies his intellectual and aesthetic demands, it does not satisfy his ethical and religious demands. Here it is a question not

merely of formal structure but of individuality and freedom. The turning towards the higher is for Plotinus true liberty. But the turning towards the lower is in the first instance at any rate a choice, though the soul, by becoming immersed in the lower, becomes a slave. Plotinus is not troubled by the antinomy in his philosophy. He follows either side of the antinomy according to his interest.

The antinomy of structural determinism and individual contingency is fundamental in human experience. It was not made by Plotinus. Modern physics is confronted by the same antinomy in the shape of structural levels in nature—the levels in the atomic field, the levels in the cosmic field of radiant energy—and of individual entities or quanta which seem to have a range of "choices" and may appear at any of the levels. It cannot be predicted at which level the individual electron shall appear, but from empirical data we can state statistically the probability of its appearance at a particular level. For Plotinus the interest in the individual is ethical and religious, for physics it is descriptive. But the fundamental antinomy of structure and individuality is the same. Had he thought about the antinomy, he might have tried to solve it by saying that the structural levels are fixed and eternal, but the human soul has the capacity to choose at which level it will live and thus to determine its destiny. Thus the logical and aesthetic demands, on the one hand, and the ethical and religious demands, on the other, can both be satisfied.

CITATIONS IN CHAPTER 9

1. E. (*Ennead*), V. 8. 7; M. (*MacKenna*), IV, p. 82.
2. E., V. 8. 7; M., IV, p. 81.
3. E., VI. 9. 6; M., V, pp. 244, 245.
4. E., VI. 9. 8; M., V, p. 248.
5. E., V. 5. 12; M., IV, p. 60.
6. E., V. 2. 1; M., IV, p. 16.
7. E., V. 5. 9; M., IV, p. 57.
8. E., VI. 9. 9; M., V, p. 249.
9. E., III. 9. 4; M., II, p. 139.
10. E., IV. 8. 6; M., III, p. 150.
11. E., IV. 8. 4; M., III, p. 149.
12. E., V. 2. 1; M., V, p. 16.
13. E., V. 2. 2; M., IV, pp. 17, 18.
14. E., V. 5. 7; M., IV, p. 55.
15. Smaller *Logic*, trans., William Wallace, p. 154.
16. E., V. 2. 1; M., IV, p. 16.
17. E., V. 2. 1; M., IV, pp. 16, 17.
18. E., II, 3. 18; M., II, p. 177.
19. E., V. 1. 2; M., IV, p. 3.
20. E., IV. 3. 9; M., III, p. 19.
21. E., IV. 4. 36; M., III, p. 92.
22. E., V. 8. 7; M., IV, p. 81.
23. E., IV. 3. 9; M., III, pp. 19, 20.
24. E., IV. 3. 9; Guthrie, II, p. 405.
25. E., I. 8. 7; M., I, pp. 100, 101.
26. E., III. 6. 6; Guthrie, p. 362.
27. E., V. 9. 12; Guthrie, p. 115.
28. E., V. 9. 14; M., IV, p. 101.
29. *Ibid.*
30. E., I. 6. 6; M., I, p. 85.
31. *The Philosophy of Plotinus*, W. R. Inge, I, pp. 135, 136.
32. E., II. 4. 16; M., II, pp. 195, 196.
33. E., IV. 9. 5; M., III, pp. 157, 158.
34. E., I. 1. 3; M., I, p. 31.
35. E., II. 9. 7; M., II, p. 224.
36. E., II. 9. 2; M., II, p. 218.
37. E., IV. 8. 5; Guthrie, p. 127.
38. E., V. 1. 1; M., IV, p. 1.
39. E., II. 9. 7; M., II, p. 225.
40. E., VI. 9. 9; M., V, p. 249.
41. E., I. 6. 8; M., I, p. 88.
42. E., I. 6. 9; M., I, pp. 88, 89.
43. E., I. 6. 7; Guthrie, pp. 50-52.
44. E., IV. 4. 41; Guthrie, p. 505.

Chapter 10

CREATION IN THE HEBREW AND CHRISTIAN TRADITION

The Dualism of Plato and the Prophets

Two great traditions form the background of the occidental interpretation of creation—the Hebrew scriptures and Platonism, or, more precisely, *Genesis* and the *Timaeus*. Both of these traditions are dualistic. In each case the dualism has an ethical motive. The first chapter of *Genesis* was written after the Exile and has for its background the ethical interpretation by the great prophets who created the religion which is the momentous contribution of the ancient Hebrews to humanity and which found its completion in the teachings and personality of Jesus of Nazareth. The ethical dualism of the prophets became a metaphysical dualism through the contact of the Hebrews with the Persian religion during the Exile. The dualism of the intense ethical consciousness of the prophets found its counterpart in the dualistic cosmology of the first chapter of *Genesis*.

"In the beginning God created the heaven and the earth. And the earth was without form and void; and darkness was upon the face of the deep. And the spirit of God moved upon the face of the waters. And God said, Let there be light and there was light." This is the rendering of the first three verses of the first chapter of *Genesis* in the King James' version. A suggested paraphrase brings out the meaning more clearly: "When God began to create the heaven and the earth—the earth being without form and void, and darkness being upon the face of the deep, and the spirit of God brooding upon the face of the waters—God said, Let there be light and there was light."[1] In the beginning there were God and chaos. And the spirit of God ordered chaos. The rest of the familiar epic need not be told. In its simple sublimity, the Hebrew interpretation of creation marks a far advance upon the Babylonian myth where the young sun-god, Marduk, is represented as doing battle with the chaos-

mother, Tiâmat, and, having won the victory, divides her body and makes heaven and earth out of the two parts. The point of view of the author of the first chapter of *Genesis* is anthropomorphic. Man is conceived as the end of creation. The development of mind and soul may well be regarded as the end, for without mind there can be no value. And the author's point of view is geocentric. He has no conception of other worlds than ours. This is not to be wondered at since the conclusive evidence of other material worlds came only with the spectroscope. The early Greek philosophers, more imaginative than the Hebrews, pictured to themselves a plurality of worlds similar to our own. But they lacked evidence. Anaxagoras came the nearest to it, when, after the examination of a large meteor, which fell in the Hellespont, he conjectured that "the moon is earth and the sun a red hot stone," but this was a large hypothesis on small evidence. The Hebrew prophets thought of the firmament as a canopy over the earth. In the language of the unknown prophet of the Exile: "He stretcheth out the heavens as a curtain and spreadeth them out as a tent to dwell in." In the firmament God set the great and lesser lights—the sun to light man by day and the moon and the stars by night. For one brief history the scroll of the heavens is unfurled and then rolled up again like the tents of the Arabs.

If we take the geocentric point of view and regard the earth with its apparent firmament as the world, then it is true that we must postulate a beginning. Modern science agrees with *Genesis* in postulating a beginning for the earth and the perspectives from the earth. If we could have looked upon the earth in its first gaseous state, we too would have felt that it was "without form and waste." We should indeed have to start farther back than the first state of the earth, for our earth was once part of a gaseous sun and our sun had its origin in some nebulous condition of matter. But wherever we start, the problem is the same—how to account for the organization which we find, with its plurality of patterns and levels, from a more primitive and less organized state in which these patterns and levels did not exist. The intuition of *Genesis* is sound that, with-

out "the spirit of God brooding upon the face of the deep," the advance of nature as we know it is inconceivable. The conception of the order of creation in *Genesis* is also in principle correct: there has been an advance from a lower comparatively unorganized state of matter through a gradation of levels up to man. That the description does not tally in detail with the story in the rocks, as deciphered by modern paleontology, and that the moving picture of creation is speeded up into six days detracts not in the least from the divine inspiration of the poet who gave us the true intuition—that to understand the origin of the world it requires more than primal matter, whatever that may be. It requires also divine Genius.

The language of the first chapter of *Genesis* is oriental. It suggests the oriental despot calling things into being by his word. The tragedy of the Exile had impressed the Jews with the power of a despot's command. The older version of creation in the second chapter of *Genesis* is closer to the artistic genius of the Greeks. We are told that God moulded man by his fingers out of the clay, and then breathed into him a living soul. But the dualism is the same—matter and formative genius. Creation means the transformation of an otherwise chaotic world into a thing of order and beauty. It is the shaping of an indifferent matter into a world of value.

The biblical tradition, which has been nominally accepted as divine authority by orthodox Christianity, is dualistic. "The doctrine of a creation out of nothing—ex nihilo—is nowhere expressly taught in Holy Scripture. The first near approach to it occurs in the words of the mother of the Maccabees."[2] The passage referred to is II *Maccabees* 7:28, which reads in the standard English version: "I beseech thee, my son, look upon the heaven and the earth and all that is therein, and consider that God made them of things that were not (ἐξ οὐκ ὄντων ἐποίησεν αὐτὰ ὁ θεός)." The phrase "out of non-beings" clearly shows Platonic influence, and it might very well do so since the book was written in the first century, A.D. With Plato non-being does not mean nothing, but the world of flux as opposed to being, the realm of Ideas, of order and form. The *Vulgate*,

the Latin translation by Jerome, renders the critical part of the passage, "God created them out of nothing (ex nihilo fecit illa Deus)." The Latin had no equivalent for the Greek non-being, and so a mistranslation finally determined Christian theology on this point. Why an ambiguous passage in an unimportant book —never recognized in the Hebrew canon of the Old Testament —should be given such weight in face of the clear dualism of "Moses and the Prophets" can only be accounted for by the will-to-believe what suits our prejudices. Another passage which has been quoted by theological dogmatists to support the doctrine of creation out of nothing is the *Epistle to the Hebrews,* XI:3. In the standard English version it reads: "By faith we understand that the worlds have been framed by the word (ῥήματι) of God, so that what is seen hath not been made out of things which do appear" (μὴ ἐκ φαινομένοων). This passage is pure Platonism according to which the things which appear are fashioned out of matter without qualities. It also agrees with the first chapter of *Genesis* according to which the visible world was created by God out of the dark watery chaos. Among other biblical statements of creation which show Platonic influence is the *Wisdom of Solomon* (first century A.D.), XI:17, which speaks of the creation of the world "out of formless matter" (ἐξ ἀμόρφου ὕλης). II Peter 3:5 goes back to *Genesis* in speaking of the heavens and the earth as "compacted out of water by the word of God."

Philo, the Jew, the outstanding philosopher at the beginning of the Christian era, who was to exercise great influence on Christian as well as Hebrew theology, interpreted *Genesis* in terms of Plato's *Timaeus.* With *Genesis* and *Timaeus* he holds to a finite beginning of the world, deeming those impious who hold that the world is eternal. With *Genesis* and *Timaeus* he is dualistic in his conception of creation. "Moses . . . could not fail to recognize that the universal must consist of two parts, one part active Cause and the other passive object; and that the active Cause is the perfectly pure and unsullied Mind of the universe, transcending virtue, transcending knowledge, transcending the good itself and the beautiful itself; while the passive

part is in itself incapable of life and motion, but, when set in motion and shaped and quickened by Mind, changes into the most perfect masterpiece, namely this world."[3] Following the lead of the *Timaeus,* Philo sets forth that God first of all created the pattern: "For God, being God, assumed that a beautiful copy would never be produced apart from a beautiful pattern, and that no object of perception would be faultless which was not made in the likeness of an original discerned only by the intellect. So when He willed to create this visible world He first fully formed the intelligible world, in order that he might have use of a pattern wholly God-like and incorporeal in producing the material world, as a later creation, the very image of an earlier, to embrace in itself objects of perception of as many kinds of objects as the other contained objects of intelligence."[4] As a trained architect, who is entrusted to build a great city, first makes plans in detail in his mind before he begins the operation of building, so must we think of God. "We must suppose that, when He was minded to found the one great city, He conceived beforehand the models of its parts, and that out of these He constituted and brought to completion a world discernible only by the mind, and then, with that for a pattern, the world which our senses can perceive."[5] Such a universe of ideas "would have no other location than the Divine Reason, which was the author of this ordered frame." The reader will realize how familiar Philo is with the *Timaeus* and how keen his insight is even though he attributes all this philosophy to Moses. We cannot stop to examine Philo's allegorical interpretation of the six days of creation, nor the mystical significance which he finds in the numbers 6 and 7.* Philo was indeed only a part of an allegorical method which was to continue in the Hebrew and Christian tradition for many centuries.

The early church Fathers generally remained true to the dualism of *Genesis.* They "remained in close touch with the Jews, and therefore correctly interpreted the passage in question. Justin Martyr, quoting *Gen.* 1:1-3, says that Plato and his followers

* We shall find that St. Augustine followed in the footsteps of Philo.

'and we ourselves' have thence learned that 'through the word of God the whole world came into existence out of things subjacent and before declared by Moses.' "[1] Justin Martyr accuses Plato of borrowing from Moses. This was the general opinion of Jewish and Christian scholars in the early part of the Christian era. They recognized a common intuition in Plato and *Genesis*. By a free allegorical interpretation of scripture, they read Platonism into Moses and then concluded that Plato must have plagiarized Moses.

This tendency is well illustrated in Clement of Alexandria, a Christian scholar of great erudition and of great importance in the shaping of Catholic theology during the latter part of the second and the beginning of the third century A.D. "But the philosophers, the Stoics, and Plato, and Pythagoras, nay more Aristotle, the Peripatetic, suppose the existence of matter among the first principles. Let them know that what is called matter by them, is said to be without quality and without form and more daringly said by Plato to be non-being."[6] He thinks that they got their conception of primitive matter from "the prophetic expression, 'Now the earth was invisible and formless.' " He finds, in Plato's *Timaeus*, the consciousness of a first principle or one Creator when he says: "It is difficult to find the Maker and Father of this universe." He thinks that Plato held that the world was created by God "as a son, and that he is called its father as deriving being from him alone, and springing from non-being." Clement is even able to discover the trinity in Plato. Clement sometimes thinks that Plato received his inspiration directly from God but he generally inclines to the view that Plato derived his insight from Moses and the prophets.

For Clement, matter does not impose any limitation on God. God can do what he will, and God is just. In the language of the *Timaeus:* "God, therefore, as the old saying has it, occupying the beginning, the middle, and the end of all that is, keeps the straight course, while he makes the circuit of nature; and justice always follows Him, avenging those who violate the divine law."[7] But he does not doubt that God is also beneficent, and he devotes considerable argument to show that there is no con-

flict between God's justice and beneficence. He accepts with Plato the freedom of man: "And each one of us is a partaker of His beneficence, as far as he wills. For the difference of the elect is made by the intervention of a choice worthy of the soul, and by exercise." By aid of the fiction of Moses, Clement manages to be a good Platonist. He finds the archetypes of Plato in the anthropomorphic expression that man was made in the image of God, and Plato's conception of the final goal of virtue as assimilation to God was recognized to be good scripture because Clement and other Christian theologians believed it. Christian theologians were eclectic and used material as it suited them from various schools. Thus Clement uses the beautiful thought of the Stoics that "God gives spiritual tone to the universe."

There is no doubt a real kinship of intuition between Plato and the scriptural tradition. In either case cosmological dualism was the result of ethical dualism. The contrast between that which has form and that which is disorderly is too patent everywhere in our experience. The Greeks had a different conception of morality from the Hebrews. For the Hebrews the moral is the right; and the right is that which is commanded by the will of God. For the Greeks the moral is the good, and the good is the realization of the beautiful life, which is also the happy life. For the Greeks the good and the beautiful are not two different things but fundamentally one thing. They both imply measure as contrasted with the indefinite. They involve the working over of the amorphous material of life into a whole of order, harmony and proportion. But you have to reckon with the inertia of the material in doing so, whether it is human material or inorganic material. We should ever try to transform the indefinite and chaotic in our private lives and in society into the good and the beautiful. This is the immortal expression of Greek genius in its greatest representative, Plato. And the logic of Plato, like the logic of the poet of *Genesis*, led him to the conclusion that the struggle between order and chaos is not merely a human struggle but a cosmic struggle.

The two great traditions—*Genesis* and Plato's *Timaeus*—fur-

nish the true intuition which must be the basis of the philosophy of creation. They set forth the eternal faith in value and meaning in the world in which we are placed. But they also recognize that in our world there is resistance to the realization of ideals. There is always the relatively unformed which must be induced to take on order. Without the ordering genius of God the world would be chaos. Order is not completely realized in our world because of the resistance which the lower offers to the incarnation of the higher. This inertia is characteristic of nature everywhere, but it is most strikingly manifested in the resistance of human wills to the ideal order for which God and his ministers work. Yet this pluralism is the condition for the realization of the great ethical drama. If it is the basis for the great refusal, it is also the basis for the great affirmation—for ethical and religious union with God.

Plato and the Hebrew prophets started from human experience and its problems. They were tragically conscious of the discrepancy between the ideal as they envisaged it and the facts as they found them. They were inspired by the conviction that God is good and righteous altogether and that for evil things we must find other causes. To get a cosmic setting for the moral problem they invented the myth of a creator fashioning a world out of chaos. Both the Platonic myth and the Hebrew myth imply the inertia of the material to be fashioned. This would account for maladjustment and evil. But the intense practical struggle with evil suggested both to Plato (in the tenth book of the *Laws*) and to the author of the third chapter of *Genesis* (both of whom were no doubt influenced by the much earlier prophet Zoroaster) the presence of an evil soul that works for wrongness. Man encounters the snake in the Garden of Eden. The ethical idealists of Judaea and Athens refuse to believe that God tempts a man to evil in order to destroy him. The personification of the principle of evil as Satan, with hierarchies of evil powers at his command, is due to the contact of the Hebrews with the more developed dualism of the Persians. The enigmatic drama in the book of *Revelation* of a war in heaven between Michael and his angels and the dragon and his angels, with the

defeat of the latter and their ejection from heaven, is an imaginative attempt to find an explanation for the human struggle with evil. But it merely puts the problem farther back. It does not solve it. How did sinful pride arise among the angels? St. Augustine raises the question whether God did not give the fallen angels sufficient grace. But this would throw the responsibility upon God. Such a suggestion would have seemed blasphemy to Plato and the prophets of Israel. Whether we approach the problem through the cosmological dualism of form and chaos or through the more popular personification of good and evil, the dualism is evident; and it is nowhere sharper than in the scriptures which make up the New Testament. The struggle between good and evil is felt to be more than a human struggle. It is enacted on a cosmic stage. "The whole creation groaneth and travaileth in pain together until now," waiting for "the glorious liberty of the children of God," to use the language of the first Christian theologian, St. Paul.

The Triumph of Monism

We have seen that both Jewish and Christian theologians, at the beginning of the Christian era, followed the dualistic tradition of Plato and the Hebrew prophets. But with the third century the monistic conception of creation—creation out of nothing—won its fateful triumph. The change of attitude seems to have been comparatively sudden, though there were no doubt isolated expressions of it before that time. The rhetorical expression of the idea of an omnipotent God is to be found in all the great religions. We find it in the unknown prophet of the Exile: "I form the light, and create darkness: I make peace and create evil: I the Lord do all these things."[8] But this does not mean arbitrary creation. The same prophet goes on to say, in the spirit of the later writer of the first chapter of *Genesis:* "God himself formed the earth, he hath established it, he created it not in vain, he formed it to be inhabited." Nor does he create evil arbitrarily: "I the Lord speak righteousness, I declare things that are right." Moral distinctions are absolute for God and man. "Woe unto them that call evil good,

and good evil." The evil which God creates is remedial. The rhetorical idea of omnipotence is frequently held together with the dualism of formative agency and matter-to-be-formed. Clement of Alexandria holds to both.

The first apparent suggestion of the monistic conception occurs in the second century A.D. in Tatian's *Address to the Greeks* (about 150 A.D.); and here we also find a clear distinction between the expression of God in the *Logos,* the Son, and his expression in creation: "By his simple will the *Logos* springs forth. . . . But he came into being by participation, not by abscission. . . . For just as from one torch many fires are lighted, but the light of the first torch is not lessened by the kindling of many torches, so the *Logos,* coming forth from the *Logos*-power of the Father has not divested of the *Logos*-power Him who begot Him. I myself, for instance, talk, and you hear; yet certainly I who converse with you do not become destitute of speech (*Logos*) by the transmission of speech, but by the utterance of my voice I endeavor to reduce to order the unarranged matter in your minds. . . . And as the *Logos,* begotten in the beginning, begot in turn our world, having first created for himself the necessary matter, so also I, in imitation of the *Logos,* being begotten again, and having become possessed of the truth, am trying to reduce to order the confused matter which is kindred to myself. For matter is not, like God, without beginning, nor, as having no beginning, is it of equal power with God—begotten, and not produced by any other being . . . , but brought into existence by the Framer of all things alone."[9] This looks like an unequivocal affirmation of the creation of matter. But it is likely that Tatian had in mind the creation of formed matter. This seems to be indicated by the analogy of the speaker, trying to form the confused matter of his audience into his *Logos.* The whole context of ideas—the *Logos* coming forth from the *Logos*-power of the Father in the beginning to create the world—is reminiscent of Philo. We know that Tatian later became an outstanding dualist of the Manichaean sort, holding that matter is the principle of all evil. Tatian is a contemporary of Justin Martyr and a teacher of Clement of Alexandria—both

teachers of high standing in the Church. They were Platonic dualists, as we have seen.

The theologians who established the monistic conception of creation as a doctrine of the Church were Origen and St. Augustine. Origen, the fellow-pupil of Plotinus at the feet of Ammonius Saccas in Alexandria, in the first part of the third century, was a great scholar and writer and laid the foundations of Catholic theology, though on account of some daring speculations he was not recognized as an authority by the church and hence was chiefly effective by his influence on theologians like St. Athanasius and St. Augustine, who were approved. But Origen convinced the church that the dualistic doctrine of a formative agency and matter limited the omnipotence of God and was unworthy of God. His conception of matter is Aristotelian: "By matter therefore we understand that which is placed under bodies, viz. that by which, through the bestowing and implanting of qualities, bodies exist; and we mention four qualities—heat, coldness, dryness, humidity. These four qualities being implanted in the ὕλη, or matter (for matter is found to exist in its own nature without those qualities before mentioned), produce the different kinds of bodies. Although this matter is, as we have said above, according to its own proper nature without qualities, it is never found to exist without a quality. And I cannot understand how so many distinguished men have been of opinion that this matter, which is so great, and possesses such properties as to enable it to be sufficient for all the bodies in the world which God willed to exist, and to be attendant and slave of the creator for whatever forms and species he wished in all things, it receiving into itself whatever qualities He desired to bestow upon it, was uncreated, i.e. not formed by God Himself, who is the creator of all things, but that its nature and power were the result of chance."[10] That matter should be furnished God by accident seems incredible to Origen, since "matter is such as God would have formed it." He goes so far as to say that those who hold that "matter is uncreated and co-eternal with the uncreated God are guilty of like impiety with those who deny the creative power of providence." Origen quotes a passage

already referred to in *Second Maccabees* in support of his doctrine, but it is clear that it rests on *a priori* grounds as to what is complimentary to God.

While Origen maintains the omnipotence and omniscience of God, he also maintains the freedom of the individual. The salvation of man must come through his free choice and is conditioned upon the zeal and capacity of the individual. He tries to reconcile the justice and goodness of God. All punishment is corrective. He believes that there is a germ of good in every one and that through the fire of punishment all men will eventually be brought round to see the evil of their ways and so be saved. While sin is dissolution, he cannot believe that God would allow the soul to be destroyed. The purgatorial fire will somehow solidify the soul and restore it. But while all souls will eventually be saved, it does not mean that they will be saved in the same way. "One is the glory of the sun, another the glory of the moon, another the glory of the stars." With the Stoics he believes in a succession of cycles, but there must be just the least interval between the cycles to prove God's creative power. Moreover, there cannot be complete repetition of events in different cycles, for since man is free there is bound to be difference, and one cycle may be better or worse than another. The significant thing about Origen is that he bases theology on *a priori* reasoning instead of making it an interpretation of human ethical experience, as Plato and the prophets had done. Origen's method was followed henceforth by Christian theologians and was made authoritative for the church by the dominant personality of St. Augustine.

There were many forces at work to produce the intellectual climate in which the monistic conception was born. In Alexandria, the melting pot of civilizations, oriental mysticism and Greek rationalism met and produced a new offspring—Neoplatonism. With mysticism came a revival of magic and a loosening of the restraints of reason. Theology abandoned the analogies of experience and fell back on the miraculous. One of the most potent reasons for the monistic conception of creation was the danger that Christianity might be conquered by the revival of Persian dualism in the form of Manichaeism. This was

congenial to the Hebrew tradition which had absorbed a considerable portion of this dualism through the Exile. One of the foremost Catholic theologians, St. Augustine, was for some time a follower of this doctrine. In the Alexandrian atmosphere the dualism of good and evil became the dualism of form and matter, light and darkness. Matter, as the negation of form, was conceived as absolutely evil and absolutely removed from God. Such a dualism made it necessary to create a hierarchy of intermediate beings between God and matter. Such a hierarchy was developed in Neoplatonism and, in a more fantastic way, in various Gnostic philosophies. This dualism was used as an argument against any conception of the incarnation of God in matter. For if matter is absolutely evil, how can God incarnate himself in matter? To this interpretation Christian theologians like St. Augustine replied that God did incarnate himself in matter and therefore matter can not be evil.

If Christianity was to maintain its central doctrine of divine incarnation, it was necessary to remove the stigma from matter. It is true that there was no such stigma attached to matter in the *Timaeus*. Here matter is neutral so far as form is concerned and can be persuaded by the Creator to take any form, though cosmic laziness prevents it from realizing form perfectly. Unfortunately this conception of matter had been lost sight of; and Christian theologians had to struggle against the Alexandrian conception of matter as evil and the consequent transcendence of God in a world left godless. A way out was to conceive matter as created outright by God. God created the world, form and matter, "without interval of time". Form and matter, according to St. Augustine (and later on St. Thomas) are concreated as the tones and the melody. St. Augustine recognized that *Genesis* says nothing about the creation of primal matter. But then it says nothing about the creation of angels. Such a conception of creation abandons the familiar analogy of the artist. The creation of the world is for St. Augustine the greatest of miracles. But why not a miracle?

One of the important reasons for the change of Christian theology from the cosmological dualism and ethical pluralism of

Plato to the monistic doctrine of the Middle Ages is to be found in the genius of language. When the Latin church became the dominant part of Christianity, it was necessary to translate Greek theology, the original frame of Christianity, into Latin. But this presented difficulties, as we saw in Jerome's translation of the ambiguous phrase "out of non-beings" into "out of nothing". The Latin language had not been a medium for philosophical thought and lacked certain distinctions which were present in the Greek tradition. The Platonic concepts of being and non-being had no equivalents in Latin. For Plato, being means form; and when Plato speaks of God as the author of being, he means that God is the author of form. God contributes measure and number to the primitive chaos. For the Latin mind, being means existence; and to say that God is the author of being means that God is the author of existence. He creates everything outright—form and matter. Again, non-being for Plato means the world of flux which cannot be grasped by reason, which knows through form, but is known in a fashion by perception and opinion. To the Latin mind non-being means non-existence, non-entity. To say that God made the world out of non-being means that God made the world out of nothing. God is being in the supreme sense, i.e. he exists in himself and everything depends on him. God is the absolute substance. This meaning of substance is continued later in Descartes and Spinoza.

While Western theology from the time of Origen holds to creation out of nothing and strives to exclude any kind of dualism or pluralism at the root of creation, it cannot be said to be altogether successful. This is not to be wondered at since neither Greek thought nor its scholastic successor ever really succeeded in getting a concept of nothing. That creation is out of nothing seems to establish a sort of weakness in creation for St. Augustine and his successors. Why did angels and man fall from their high estate? It was not from the essence communicated by God, the essence of all essences. "No essence at all is contrary to God, the chief essence, and cause of essence of all,"[11] says St. Augustine. The fall was due to a defect in the will. But

the will was also communicated by God and therefore was good. "Let none therefore seek the efficient cause of an evil will; for it is not efficient but deficient, nor is there effect but defect: namely falling from that highest essence, unto a lower, this is to have an evil will."[12] To seek for a cause of an evil will is like trying "to see the darkness, or hear the silence."[13] Evil is privation. St. Augustine confesses his ignorance of such privation. We know by form, we cannot know by failure of form. "This I know, that God's nature can never fail in time, nor in part: but all things that are made of nothing may decay: which do notwithstanding more good as they are more essential: for then they do something when they have efficient causes: but in that they fail, and fall off, and do evil they have deficient causes: and what do they then but vanity."[14]

It is clear to St. Augustine that, if angels and man had been born of God, they could not have fallen. It was because they were created out of nothing that they fell short of divine perfection and therefore could fall. In this St. Anselm agrees with St. Augustine. But how could nothing limit God? St. Thomas gets around the problem by postulating indeterminism. But how could the indeterminism of the parts emanate from the ultimate cause which is immutable wisdom? Moreover, according to St. Thomas, the divine creative light weakens in the degrees of creation until it is lost in matter. If creation proceeds from God alone and if it is made out of nothing, why should the divine power diminish? What inertia could nothing furnish? Leibniz, who followed the Scholastics in assuming creation out of nothing, postulates an inertia on the part of the monads in order to account for their inequality. But where did the inertia come from, if the monads, as Leibniz maintains, are "fulgurations" from God? Hegel postulates a fall to account for the absolute's estrangement from itself. But how could there be an estrangement in the absolute? Monism, when it finds itself in straits, always falls back upon some sort of dualism or pluralism.

The ontological argument is based upon the definition of God as absolute being. This is made clear by Spinoza, whose whole

system rests upon his definition of substance. Perfection for Spinoza means merely that substance or God is self-existent and self-explanatory. And Spinoza can conceive of only one such substance, since to conceive two or more substances means that they must have a common concept; hence they are not independent. Spinoza makes explicit the ontological argument of St. Anselm. When St. Anselm in the eleventh century had argued that there can be only one absolute being, he had followed the same line of reasoning. If there are many beings, they must have the predicate of being in common. Hence there is only one being—the universal being in which the finite beings participate. Everything that exists must be regarded as subsumed under being which is the most universal.

St. Anselm did not grasp clearly that his ontological argument rests on definition. In his cosmological argument in the *Monologium* he had introduced the conception of value, with its scale of degrees of higher and lower, into his conception of being. God is the absolute goodness and wisdom. He is the most perfect being. In the *Proslogium*, St. Anselm fused the conception of value with his ontological predicate of being. The most real being is also the most perfect being. "Why, then, has the fool said in his heart that there is no God, since it is so evident, to a rational mind, that Thou dost exist in the highest degree of all? Why, except that he is dull and a fool?" And again: "Thou canst not be conceived not to exist and rightly. For, if a mind could conceive of a being better than Thee, the creature would rise above the Creator; and this is most absurd." But the predicates of better and higher are irrelevant (as Hegel points out) to the ontological predicate which is that God must be conceived as absolute being and that his non-existence cannot be conceived. Descartes saw this clearly. For him the idea of God implies his existence, just as the idea of a triangle implies that its three angles are equal to two right angles. To make explicit what is meant by being, St. Anselm finds it necessary to distinguish between absolute being and contingent being; and here he falls back upon the cosmological argument. Of course after defining God as absolute or infinite being there is no need for argument.

Such a definition neither requires nor implies any predicate of value. There is no *a priori* reason why an all-powerful being should be all-good. The conception of a hierarchy of worth is derived from the Platonic tradition. But the argument from degrees of worth to an absolute standard of worth would give the God of Plato, not the absolute source of all existence, which is St. Anselm's God.

The two motives—God as the source of existence and God as the standard of value—are intertwined in the Middle Ages. The former, which is an inverted Aristotelianism, derives from Porphyry's classificatory hierarchy which proceeds from the more universal to the less universal, but the Scholastic realists added the interpretation that the most universal generates the subdivisions under it down to the particulars. This makes creation synonymous with division. The mediaeval theory of creation is a veiled apotheosis of formal logic. Erigena entitles his chief work, in which he sets forth the scheme of creation, *De Divisione Naturae*. The individuals are the last spray of the creative wave. It was not far from this to the extreme realism of William of Champeaux in which only the universal is regarded as real and the individual becomes a mere *flatus vocis*. This is the antipodes to the extreme nominalism of Roscellinus in which the individuals alone can be said to exist. The other motive—God as the standard of value—also reverberates through the Christian tradition. Through degrees of worth we rise to the absolute perfection which gives the degrees their meaning. We have seen how St. Anselm fuses the two motives and makes the source of existence identical with the source of perfection. St. Thomas has the acuteness to see that St. Anselm's ontological argument can be convincing only to those who accept his definition. But the ontological argument returns, though with greater logical clearness, in Descartes, Spinoza and Leibniz. Leibniz, however, makes the qualification that the definition of the most perfect being must be shown to be self-consistent. Since the definition is self-consistent, it is valid ontologically, i.e., God must exist. "*Assuming that God is possible he exists,* which is the privilege of divinity alone. We have the right to assume the possibility

of every being, and especially that of God, until some one proves the contrary.''[15]

The most potent influence in the climate of valuation, which led to the victory of the monistic conception of creation, was a silent influence, unnoticed by the theologians. It was the influence of the spirit of Rome. The doctrine of omnipotence derives from the will-to-power by the Roman state. The dominating attitude of Plato and the Hebrew prophets was ethical. They proceeded from the consciousness of the ethical struggle in the individual and society to construct a picture of the universe which should furnish a setting for this struggle. This logically led to a dualistic or pluralistic result. But the dominating spirit of Rome was power. The pluralistic world of Mediterranean peoples was brought into unity by the omnipotence of Rome and Roman law—the objectification of the Will of Rome. There were great empires before Rome. But they were dominated by personal despots who enforced their will for a season. The dominance by Rome was impersonal. The omnipotence of the state took the place of the omnipotence of a personal despot. Emperors came and went, but Roman administration remained the same, and one people after another succumbed to Roman law. It was inevitable that the genius of Rome should silently but effectively transform the religious conceptions of the Roman world. If the conception of God by the Hebrew prophets had been dominated by the feeling for righteousness and the Greek conception by the feeling for beauty, it was inevitable that the Roman conception should be dominated by the feeling for power. It is true that St. Augustine, the authoritative interpreter of Roman Christianity, tells us that ''good created the world''—a reminiscence of Platonism. But the attributes of God which give the fundamental tone to his theology and the theology of the Church are omnipotence and omniscience. There must be no limitation to God's power and knowledge. It is significant that in the development of Roman theology, as finally crystallized in St. Thomas Aquinas, the Father is characterized by power and the Son, the co-eternal expression of the Father, by wisdom. Love is represented by the third person of the Trinity, the Holy

Spirit, which, though the only operative part of divinity in the temporal world, is always theologically vague. Power and wisdom are for St. Thomas complementary conceptions. God creates the world through his wisdom, but God knows because he can create, and only the creator knows intimately and truly. God's omnipotence is governed by a law inherent in God himself, as the omnipotence of Rome was governed by a law which was the expression of Rome.

The feeling of the omnipotence of the Roman state became dominant in the philosophical and theological conception of the universe when Rome was tottering to its fall in the fifth century A.D. This might be used to illustrate the pregnant saying of Hegel that when philosophy arrives on the scene, the owl of Minerva has already taken its flight. Philosophy is generally retrospective. But in this instance, while philosophy was no doubt retrospective, it was also prophetic and compensatory. It was the expression of a social instinct of self-preservation. The social order of Rome was crumbling everywhere as the result both of inner decay and of the barbarian invasions. When St. Augustine, the philosopher of omnipotence, was dying, the barbarians were attacking Hippo, the home city of the philosopher in northern Africa, and had already taken the city when he died, though he did not know it. Political Rome had lost control, but a spiritual Rome was building an empire on its ruins, and far beyond its boundaries; and was trying to control the passions of men and to stem the tide of disintegration. This spiritual Rome, born out of political Rome, had absorbed the Roman feeling of omnipotence, but it was concerned in the first instance with controlling the souls of men.

So little community did St. Augustine feel with political Rome, that he characterizes Rome as Babylon, and identifies it with the city of this world, in bitter conflict with the City of God, i.e. the Church. We are told that Mankind, since the Fall, is "divided into two sorts: Such as live according to man, and such as live according to God. These we mystically call 'Two Cities' or societies, the one predestined to reign eternally with God: the other condemned to perpetual torment with the devil."[16]

These two cities had their original in the first man; "yet not evidently but unto God's prescience, for from him were the rest of men to come."[17] Human history is for St. Augustine the dramatization of the struggle between these two cities. "Two loves have given original to these two cities: Self-love in contempt of God unto the earthly, love of God in contempt of one's self to the heavenly; the first seeks the glory of men, and the latter desires God only as the testimony of conscience, the greatest glory."[18] St. Augustine shows real insight into the meaning of an earthly city. "The people is a multitude of reasonable creatures conformed in a general communication of those things it respecteth."[19] But the earthly city aims merely at "earthly peace" and is concerned "only to have uniformity of the citizens' will in matters pertaining only to morality." This has its value. The heavenly city "uses this peace also . . . as far as it may with safe conscience."[20] But "we may not imagine men's unjust decrees to be laws." Making obedience to the established order dependent upon one's conscience is indeed a revolutionary doctrine, which was eventually to be turned against the Church itself when it was the established order. But St. Augustine is thinking of the immediate problem—the responsibility of churchmen to the Roman community. At best the virtues of the worldly man are "splendid vices." It is only in the church that there is salvation. What St. Augustine was proclaiming was the omnipotence of the Church over the souls of men. Since the Church is the vice-gerent of God on earth, this implies that it, as the higher, should dominate the political state as the lower. This implication was seen when the Church had reached maturity and was even made effective at times, as with Hildebrand (Gregory the VIIth) in the eleventh century and with some of his successors. It is embodied into theology by St. Thomas.

What concerns us here is the importance of the doctrine of omnipotence for the Church. The Church claims omnipotence over men's souls and therefore over the conduct of man. It claims the keys of heaven and hell by divine endowment. It therefore has a monopoly of salvation—the most vital monopoly

in the world to people who believe in a life beyond the grave. And there must be no limitation to this monopoly. The impotence of man is the corollary of the omnipotence of the Church. After the Fall, man is incapacitated for spiritual initiative, though St. Augustine still permits man a worldly choice—"a choice between vices." He succeeded in suppressing effectively the doctrine of Pelagius that salvation depends upon the initiative of the individual. God must give us "both to will and to do" in spiritual things.

The Fall of man is not an individual fall but the fall of the race. St. Augustine holds to the biological solidarity of humanity. "It was God's pleasure to propagate all men from one, both for the keeping of human nature in one similitude, and also to make their unity of original be the means of their concord in heart."[21] This biological solidarity of humanity accounts for the Fall of the human race through the first man. Mankind in Adam committed "so great a sin, that their whole nature being thereby depraved, was so transfused through all their offspring in the same degree of corruption, and necessity of death . . . that all would have been cast headlong in the second death, . . . had not the undue grace of God acquitted some from it." This obviously implies traducianism, or the presence of all souls in Adam, but St. Augustine and the Church refused to see this and held to the individual creation of souls. The important thing is that man is impotent to will to be saved. Salvation is a gift from above, which means from the Church. The possibility of individual initiative is branded, in theory at least, as the Pelagian heresy. Even St. Thomas, who admits indeterminism or the arbitrary choice by the will, does not think that a man can will to be saved. The omnipotence of the Church must be maintained and that requires the impotence of the individual. And the omnipotence of the Church presupposes an omnipotent God. The Church is the sole dispenser of grace. A man is saved through the sacraments of the Church. No unbaptized person can enter heaven. Salvation means membership in the Christian community which is sustained by the eucharist.

The Church is the guardian of truth as well as of the sacra-

ments. The pious attitude is: "I believe in order that I may understand," but one must believe even though it seems absurd to our finite understanding. The final attitude in ultimate things is mysticism, and the Church is the guardian of the mystery. Naturally the Church was opposed to individual inspiration, and Joan of Arc paid for her voices with her life. Of course if one is a saint one may have special privileges, and now Joan of Arc is a saint. In brief, the omnipotence of the Church extended through the whole range of life. Since nature is a miracle, its order can be set aside for new miracles; and the Church is the guardian of miracles. In the greater part of the Middle Ages there was no established body of truth in regard to nature except the Ptolemaic system of astronomy. There was little interest in what we call science. When new methods were sensed, as in the case of Roger Bacon, the Church followed its intuition; and Roger Bacon was confined in a dungeon for twenty years, without any explicit charge. After St. Thomas, Aristotle was accepted by the Church as the authority in scientific matters, and the pioneers of modern science had to battle against the authority of Aristotle.

Predestination was the logical consequence of the monistic conception, as St. Augustine made clear. God being omnipotent and omniscient foresaw all the consequences of creation and took steps accordingly. God did not determine that man should fall. This was left to man's free choice. Obviously there could be no indeterminism in man's choice, or God could not have foreseen the outcome. Those that are to be saved were elected from eternity. All events lie in "His unchangeable will at whose disposing all time past has been, and to come, is. He moves all things in time but time moves not Him, nor knows He future effects otherwise than present. Nor hears our prayers otherwise than He foresees them ere we pray."[22] Why then pray for the damned? Because we do not know. St. Augustine does not say expressly that men are predestined to be damned. But this was easily seen to be a logical consequence of his doctrine. If not elected, men would remain in a state of damnation. The doctrine of predestination, while not expressly repudiated, has always

been a thorn in the side of the Church. Local propaganda of predestination was effectively suppressed in the early Middle Ages. It is easy to see why the Church did not favor the doctrine. It was a repudiation of the omnipotence of the Church. It made the Church useless. But the doctrine was retained as a mystery. The pious St. Anselm wonders at it. "By no consideration can we comprehend why, of those who are alike wicked, thou savest some rather than others, through supreme goodness; and why thou doest condemn the latter rather than the former, through supreme justice."[28] But St. Anselm is convinced that what God wills is merciful and just. And since we all merit damnation, no one has a right to complain. Caesar may pardon whom he will. The doctrine of predestination, if really believed, would lead to fatalism. But the Church held to its omnipotence to save and refused no one, who conformed to the Church.

The Relation of God to Creation

The frame-work of the Christian conception of creation was borrowed from contemporary Greek thought. In this adaptation Jewish philosophy in Alexandria acted as intermediary. The Platonic ideas are put in the Mind of God by Philo. The tendency to personify the creative activity was also prepared for Christianity. According to Philo, God created the world through his Wisdom, the *Logos*. For Plato there was no such distinction between God and the creative Activity. God, being himself the fairest and best, created the best possible world, though not a perfect world. The laziness of matter made this impossible. But Plato in the *Republic* had used the sun as the symbol of the Good and spoken of light as its child. The light became, in later development, the *Logos,* or Wisdom of God. This had already come to assume personal form in the Hebrew wisdom books which were written under Platonic influence. Stoicism eliminated the transcendent God of the *Timaeus;* and the world-soul (as in the *Laws* of Plato), instead of being conceived as created, was thought of as being itself the ultimate creative principle. But the Hebrew tradition of a transcendent God triumphed over the pantheistic tendency of Stoicism. For Philo[24] the *Logos* is both the eternal Wisdom of God and the first begotten Son of God. In the latter capacity it is the personified manifestation of God as an objective creative activity. In this rôle the *Logos* or "Word" is finite, since the created world is finite. It existed before the world and the world was made by it. In this spirit, St. Augustine distinguishes between the eternal Wisdom of God and the created Wisdom.

In Christian theology the personification of the *Logos* came to have special significance, owing to the identification of the *Logos* with a historic personality in which the *Logos* was conceived as incarnated. This identification led to a sharp break with both Judaism and Neoplatonism, which denied any direct commerce between the *Logos* and matter, the latter being conceived as evil. But Christian theology also led to a new definition of the relation of the *Logos* to God. Philo and Neoplatonism made the creative *Logos* an inferior being to God. Since Chris-

tianity craved an immediate relation to God in the incarnate *Logos,* it was necessary to conceive the *Logos* as God. The *Logos* is the expression of God in kind. It is not created but begotten. It is the eternal Son of God. After a long controversy it was finally established in the Nicene Creed that the incarnate *Logos* is of the same essence as the Father. There is no distinction in rank or quality. The rôle of creator is still reserved for the *Logos.* The Father created the world through his eternal Wisdom. Since the *Logos,* after a brief visit in the flesh, returned to the Father, it was necessary to conceive the eternal presence in history as a third person, the Holy Ghost "who proceedeth from the Father and the Son"* and is therefore of the same essence as these. The Holy Ghost becomes the mediator between the world and God. In practice the rôle of mediator is taken by the Church which thus represents the third person of the Trinity, except in extraordinary instances of divine inspiration. The Church is the dynamic side of religion once for all delivered to the Saints. By a historical process of compensation the doctrine of the Trinity is thus established. Esoterically the *personae* (which originally meant masks worn on the stage) were conceived as the manifestation of one individual God who is not a person but contains persons. The active minds in the church—St. Augustine, Erigena, Abelard, St. Thomas—tried to give an adjectival significance to the persons of the trinity on the analogy of the three functions of the human mind—will, thought and feeling—; but for popular theology the trinity meant tritheism; and the Church preferred to cloud the whole matter with mystery.

What concerns us here is the conception of the relation of God to creation. There are three theories of creation in mediaeval theology—by volition, division and emanation. The first is expressed by St. Augustine in his conception of creation as an eternal act. The second is found in Erigena, in whose theory everything proceeds from the undifferentiated first principle by division into distinctions of good and evil, being and non-

* The phrase, "and the Son" (filioque) was inserted into the creed by the Western branch of the Catholic Church, but was refused by the Eastern branch, and was one of the causes of "the great Schism" in 1054.

being, down to individuals. The language of emanation which comes from Neoplatonism is adopted by St. Thomas. But in fact all these expressions reduce to implication from Reason which is the source of creation. Neoplatonism had converted Aristotelian classification into a genetic scheme, and if you scratch the surface of expression you find Neoplatonism as the background of the various theories. This is due to the historical accident that the systematizers of Christian theology, Origen and St. Augustine, were Neoplatonists. St. Augustine's Neoplatonism is beautifully expressed in the ninth book of his *Confessions* in the touching scene at Ostia where he and his mother stand looking out into the garden: "We, raising up ourselves with a more glowing affection towards 'the self-same', did by degrees pass through all things bodily, even the very heaven, whence sun and moon, and stars shine upon the earth; yea, we were soaring higher yet, by inward musing, and discourse, and admiring of thy works; and we came to our own minds and went beyond them, that we might arrive at that region of never-failing plenty . . . where life is the *Wisdom by whom all things are made,* and what have been, and what shall be; and she is not made, but is, as she hath been, and so shall be ever; yea rather, 'to have been', and 'hereafter to be', are not in her, but only 'to be', seeing she is eternal."[25]

It was from Neoplatonism that Catholic theology derived its concept of an automatic God. Plato's God is an active personal God who suits his creativeness to his material. Aristotle's God, on the other hand, is self-contained and is concerned only with his own theoretical activity. The mystical God of Neoplatonism is absorbed in his own simple self-enjoyment. He emanates spontaneously the Platonic forms which on turning to their source become creative Intelligence and from it emanates the World-Soul from which in turn emanates the world. The whole process in Neoplatonism is automatic and non-voluntary. The metaphor of the sun, which is supposed to radiate spontaneously from its abundance without diminution, expresses for Neoplatonism the character of the creative process.

The Neoplatonic background is indeed transformed in the

mind of St. Augustine. The strong voluntarism in the psychology of St. Augustine leads him to think of the nature of God as will and of the creative process as an act of will. The Intelligence or *Logos* of God is no longer thought of as an inferior emanation of God but as an expression of the very essence of God and co-equal with him in dignity. The *Logos* is born of God, not created by God. The world, on the other hand, is not thought of as born of God nor is it a spontaneous emanation from the *Logos* as in Neoplatonism. It is a voluntary creative act by God through the *Logos* in which exist eternally the Platonic forms (especially the normative forms, truth, goodness and beauty) according to which the world is created. The created world is an act by God, but it does not express the essence of God. According to St. Augustine God gave essence to created things but not His own essence. The meaning of the hierarchy—God, Intelligence, and the world—is changed. Intelligence is placed within God as his nature, an expression in kind, while the relation of the world to God is an arbitrary relation. The world is created, but not begotten. If it were begotten, it would be of the same nature as God. The relation of the world to God is a uni-lateral relation. God did not need to create the world. He is self-sufficient. But the world depends upon the will of God "And if He withdrew His efficient power from things, they would have no more being than they had ere they were created: Ere they were, I mean in eternity, not in time: for who created time, but He that made them creatures whose motion time follows."[26] The world is nothing without God. The language of emanation was to come back into Mediaeval theology through the translation by Erigena of the *Areopagitica* of Pseudo-Dionysius (a Christian Neoplatonist of the fifth century A.D.) and is used by St. Thomas.

But in spite of the transformation of Neoplatonism, the automatic God remains. St. Augustine and his successors feel that it is due to the dignity of God to place him outside of time and space. He must be eternal. But eternity had come to have two meanings. In the Greek tradition it meant form as contrasted with temporal process. In the Hebrew tradition it meant that

which endures through all time. St. Augustine often uses the language of the Hebrew tradition: "Thou art the same and thy years fail not". But time and space are part of God's arbitrary act in creating the world. Therefore they can have no significance in God. "He moves all things in time, but time moves him not, nor knows he future effects otherwise than present."[27] God is not in time and space nor does he contain time and space. God is simple and therefore unchangeable.[28] "There was neither precedence nor subsequence in Him to alter or abolish His will, but all that He ever created was in his unchanged fixed will eternally one and the same".[29] "In his eternity and co-eternal word, He had predeterminated what was in time to be manifested."[30] "God's knowledge does not vary. He does not foresee things to come as we do. . . . He sees them, not by change in thought but immutably, be they past or not past. . . His intention runs not from thought to thought; all things He knows are in His unbodily presence."[31]

God knows and wills once and for all. There is no temporal development in God's will or knowledge. God can take account of no novelty in creation. He "hath not upon any new will made any creature." God did not "take pains." Creation involves no effort on God's part. "He but spoke the word, and by that intelligible and eternal one (not vocal or temporal) were all things created." To say that God spoke is metaphorical. He did not issue a series of commands as in *Genesis*. "What was spoken was not spoken successively, . . . but all things together and eternally."[32] When St. Augustine eliminates from the will of God any temporal implications, the will evaporates and nothing is left but an intellectual scheme of implications. He tells us, to be sure, that "the will of God belongeth to His very substance." But this substance is expressed in the Word, in God's Wisdom. And when you take out of knowledge any reference to temporal realization what remains but a system of formal logic —a syllogism, a system of geometry or arithmetic?[33]

Arithmetic plays, indeed, an important part in the mind of St. Augustine. "Thou madest all things in number, weight and measure," quotes St. Augustine from the *Book of Wisdom;* and

he gives a mystical meaning to the number six—the number of the days of creation—which owes its perfection to its being "the sixth, the third and the half: which is one, two, three, all of which are contained in six."[34] Even more mystical is the number seven, "the seventh repetition of the first day", "the day that had no even",[35] which God sanctified by rest. When the soul enters its blessed state, it will have an immediate vision of this numerical harmony of creation: "for then all the numbers (of which I have already spoken) of the corporeal harmony shall not be hid which now be hid: being disposed inwardly and outwardly through all the members of the body, and with other things which shall be seen there, being great and wonderful, shall kindle the reasonable souls with delight of such a reasonable beauty to sound forth the praises of such a great and excellent workman." In such a state of "peace of immortal man with immortal God", the soul will be able to discern the image of the Trinity which is implied in a fashion in every man's nature even before his glorification, "for we both have a being, know it, and love both our being and knowledge; and in these three no false appearance ever can deceive us."[36]

I do not mean that St. Augustine consciously reduced God to a system of ideas or numbers. But this is all that remains of the timeless will of God. God is "the essence of essences." The only thing that is contrary to God and is not contained in the immutable scheme is that which has no essence. This conception of God as "the essence of essences" runs through Scholasticism. In the language of St. Thomas: "God is the first exemplar cause of things. In proof whereof we must consider that if for the production of anything an exemplar is necessary, it is in order that the effect may receive determinate forms. This determination of forms must be reduced to the divine wisdom as its first principle, for divine wisdom devised the order of the universe, which order consists in the variety of things. And therefore we must say that in the divine wisdom are the types of all things, which types we have called ideas—i.e. exemplar forms existing in the divine mind. And these ideas, though multiplied by their relation to things, in reality are not apart from the divine essence,

according as the likeness to that essence can be shared diversely by different things."[37] St. Thomas talks the language of emanation. All the exemplars emanate from the Supreme Exemplar. But timeless emanation amounts to implication by Aristotelian logic. The world derives from the intellect of God—an eternal system of ideas. This is in effect a pure intellectualism.

This formal relation between the essence of God and the essences of created things becomes clear when we look at the problem from the point of view of knowledge. "The angels," St. Augustine tells us, "know the causes of things in the archetype." They "have foreknowledge in seeing the causes before they are come to be in time." They see the creatures "in the wisdom of God, the workman's draft" and therefore understand them better than as they exist in time. "The understanding of a line or figure does produce a more perfect knowledge of it than the draught of it in the dust."[38] The angels see the implications of the system. They are not concerned with time. They are not concerned with will but with ideas. Their light, like the light of the starry intelligences, is a cold intellectual light. It does not warm. Human minds do not now have this immediate intuition of the ideas in God's mind. Sometimes the Platonism in St. Augustine asserts itself, as when he tells us that the creature's knowledge of nature "joins with the creator's in the art that framed it," but since the fall of man this knowledge is obscure and will only come to its own when the soul enters upon its pure spiritual existence. St. Thomas shares St. Augustine's opinion about the knowledge of the angels, but holds that human knowledge of the archetypes of things must be derived by induction from sensible experience. The exemplars in the created world exist in the particulars, and by disentangling these forms from their concrete embodiment, thought can arrive at their nature as archetypes. "Only the Blessed who see God and see all in God, know all in the eternal essences; on the Earth, on the contrary, the human intellect has as its proper object the sensible, not the intelligible."[39] Spinoza, later on, stressed this difference between intuitive knowledge and conceptual knowledge, and he limits the former to the philosophically Blessed. Knowl-

edge for him, as for the Scholastics, is a purely intellectual process, freed from all emotion. The divine substance is essentially an intellectual system, and though we may love such a system with an "intellectual love" it is obvious that we cannot expect any love in return. A divine being who is not merely intellect but will and love must be known by beings who are not mere intellects but will and love; and the intellect separated from feeling and will is mere system.

It is true that the schoolmen try to give an operational significance to the creative process by using human analogies. St. Thomas uses the analogy of the craftsman: "God is the cause of things by His intellect and will, just as the craftsman is the cause of things by his craft. Now the craftsman works through the word conceived in his mind, and through the love of his will regarding some object. Hence also God, the Father, made the creature through His Word, which is the Son; and through His Love which is the Holy Ghost. And so the procession of the Persons are the type of the production of creatures inasmuch as they include the essential attributes of knowledge and will."[40] Here we seem to be dealing with a real process. "Creation, which is the production of the very substance of a thing, is reduced to power." It was a favorite idea from Clement down to look for the expression of the Trinity in creation. St. Thomas follows tradition in this respect; and he humanizes it in the analogy of the craftsman. "As it is a created substance, it represents the cause and principle"; and this is the Father who is thought of as Power. "As it has a form and species it represents the Word, as the form of a thing made by art is from the conception of the craftsman." The second Person is thought of as Intellect. The third Person is thought of as Love; and according as creation "has a relation of order it represents the Holy Ghost, inasmuch as He is Love because the order of the effect to something else is from the will of the Creator."

But the analogy of the craftsman is misleading because creation for St. Thomas is not a temporal process. Creation follows from "the divine simplicity," from "the essentially self-subsisting being." The real relation is that of dependence upon an

eternal substance. "All beings apart from God are not their own being, but are beings by participation."[41] Creation does not express any urge in God. "Absolutely speaking it is not necessary that God should will anything except Himself."[42] (And of course it has no meaning to say that God should will Himself.) St. Thomas uses this as an argument to show that it is not necessary "for God to will that the world should exist always." (To us it is an inexplicable mystery that the world should exist at all.) "The First Mover was always in the same state." How could he then begin to create the world in either finite or "imaginary time?" When we eliminate all human analogies from the concept of creator, there remains only the abstraction of the universal being, "the first principle," "the first examplar", from which everything else, essential or accidental, must be derived, and there is no place for time and therefore no place for will in such a principle. Love, which is the Holy Ghost, becomes merely a relation of order to the first principle, however much he meant in the mystical life of St. Thomas.

St. Anselm in his naïve piety makes a genuine contribution to the concept of creation by thinking of creation as expression. He contrasts expression in creation with the expression in kind—the expression of God in the Word, co-eternal with Himself. The latter is a full and perfect expression of God. "His word is nothing else than what He Himself is."[43] "And it is through the same Word in which God expresses Himself that "He expresses the created world." For the world is the expression of the thought of the Supreme Nature. "But this model of things, which preceded their creation in the thought of the Creator, what else is it than a kind of expression of these things in His thought itself; just as when an artisan is about to make something after the manner of his craft, he first expresses it to himself in a concept. But by the *expression* of the mind or reason, I mean, here, not the conception of words signifying the objects, but the general view in the mind, by the vision of conception, of the objects themselves, whether destined to be, or already existing."[44]

St. Anselm takes pains to distinguish three kinds of expression: "We express objects either by the sensible use of sensible signs, that is, signs which are perceptible to the bodily senses; or by thinking within ourselves insensibly of these signs which, when outwardly used, are sensible (when we think the same words in silence); or not by employing these signs, either sensibly or insensibly, but by expressing the signs themselves inwardly in our mind, whether by the power of imagining material bodies or understanding thought, according to the diversity of the objects themselves." It is this primary form of expression which is the expression of the Creator. It is the creation of the image of the object itself, "whether destined to be, or already existing." This is indeed an original analysis and anticipates Croce. But the question arises: If creation is expression and expression of the same eternal Word through which God expresses Himself, how can creation be a finite affair of a few thousand years? It would seem that creation should be an eternal process of an eternal thought. Nor can I see, on St. Anselm's argument, why the created world should be inferior to God, just because it is created. The Word is not inferior to God, though it is the expression of God. It is not inferior because it is a complete expression of God, though the Word conceived as Son could not exist without God conceived as Father. If the world of creation is the expression of the Word, why should it be inferior to the Word? There is nothing outside of God to prevent the expression of God, and since God is all-powerful and all-wise as well as all-good there can be no limitation in God to prevent perfect expression. Did God first create matter to limit Himself? But God can make matter what He will. It is evident that St. Anselm unconsciously brings in the dualism of *Genesis* and Plato.

Time and Space

Time and Space became crucial problems in Catholic theology and have remained so ever since. According to St. Augustine both time and space are created, and are real in the created world. They are not subjective merely but exist in nature. St. Augustine, it is true, feels the difficulty of conceiving psychological time—the consciousness of past, present and future—as objective. Past and future must in some sense exist in the present as memory and expectation. The professor of rhetoric analyses a poem into stanzas, verses, words, syllables with their individual time or measure. But this analysis of the rhythms of time presupposes the consciousness of time. "Whence it seems to me, that time is nothing else than protraction, but of what I know not; and I marvel, if it be not of the mind itself."[45] But as regards objective time, St. Augustine follows Plato and Aristotle that time is the number of motion and that therefore there could be no time before God had created the heavenly bodies with their periodicities. Since this creation happened, according to St. Augustine, 6000 years before his day, time began then, and will come to an end with the dramatic finale of creation. St. Augustine's conception of time became the dogma of the church. He recognizes the difficulty of explaining the days of creation before the creation of the heavenly bodies. But he has recourse here to another concept—that of completion. A day means the completion of that type of creation—the creation of light for example.

A more serious difficulty has to be met. There is not time in God. Creation is an eternal act. God does not create successively in moments of time. But how could God decree eternally that there should be finite creation of a few thousand years? St. Augustine recognizes the difficulty. God could not create the world in time, "because time itself Thou madest."[46] God does not precede things in time, "but Thou precedest all things past by the sublimity of an ever-present eternity; and surpassest all things future because they are future, and when they come they shall be past; *but Thou art the same and Thy years fail not.*"[47] But if time has no significance for God, how can God eternally

determine a finite period of creation? St. Augustine struggles with the problem: "I see it in a way but how to express it, I know not, unless it be, that whatsoever begins to be, and leaves off to be, begins then, and leaves off then, when in thy eternal Reason it is known, that it ought to begin or leave off; in which Reason nothing beginneth or leaveth off."[48] But this begs the question because it presupposes time. In the thirteenth century, St. Thomas is satisfied to assume a finite creation with a finite time as an article of faith, realizing that it cannot be proved by reason.

St. Augustine saw a way in which it could be made reasonable, and that was by including time in God. There can be no doubt that St. Augustine was a first class psychologist, if he could not, with his assumptions, be a first class philosopher. He gives a vivid description of an experiment of repeating a psalm that he knows and analyzes his attitude before and after repetition. Before repetition there is expectation extended over a whole and after repetition there is the consideration of a whole, including the various moments of time involved in the rhythms of the parts. There is a time-whole including time-wholes. He then proposes a daring hypothesis: "Certainly, if there be a mind gifted with such vast knowledge and foreknowledge as to know all things past and to come, as I know one well-known psalm, truly that mind is passing wonderful, and fearfully amazing; in that nothing past, nothing to come in after-ages, is any more hidden from him, than when I sung that psalm, was hidden from me what, and how much of it had passed from the beginning, what and how much there remained unto the end."[49]

But he draws back from this imaginative venture. It was contrary to his basic assumptions and would have meant a different system of theology. A philosopher in the last generation, Josiah Royce, was to take up the venture and embody it into his Absolute. St. Augustine repudiates his suggestion, and tells God: "Far be it that Thou, Creator of the universe, the Creator of souls and bodies, far be it, that Thou shouldst in such wise know all things past and to come." God is more wonderful in

being "unchangeably eternal." "Like then as Thou in the Beginning knewest the heaven and the earth without any variety of Thy knowledge, so madest Thou in the beginning heaven and earth, without any distraction of Thy action." But what could "in the beginning" mean to such a God? St. Augustine's fundamental objection to including time in God seems to be that time is incomplete and therefore imperfect. "In the eternal nothing passeth but the whole is present; whereas no time is all at once present."[50] Royce, on the other hand, considers time as complete in God. It is only for us, as finite, that time is incomplete. To God the whole of infinite time is present at once, in the same way that a few seconds may be included in our specious present. While for St. Augustine time, as time, could not be in God, St. Augustine, too, holds that God's knowledge comprehends and includes the infinite—but the infinite which is included in the knowledge of God is not an infinite of successive moments but rather the infinity of number in which "every particular being is different." As He includes the infinity of number with its law and novelty in His knowledge, so He includes the novelty of creation which proceeds by number, "so that whatsoever thing is new and unlike to all other He should please to make, it could not be new, nor strange unto Him, nor should He foresee it a little before, but contain it in His eternal prescience."[51] God's prescience is timeless. St. Augustine does not affirm or deny the possibility of a succession of different worlds, but he is sure that the freed souls remain in endless bliss and are not reborn.[52]

It seems strange that St. Augustine and his successors should have taken the phrase "in the beginning" so literally. They manage to put an allegorical explanation upon all the rest of the first chapter of *Genesis* without any respect for what was written. The dualistic picture of God and chaos was disregarded for the *a priori* prejudice that God must have created the matter as well as the form. The order of creation is likewise set aside for the Neoplatonic genetic order from the higher to the lower. Why not also treat the phrase "in the beginning" metaphorically? That is what the Academy after Plato did with Plato's dra-

matic beginning in the *Timaeus*. It is true that so far as the analogies of our limited experience go, it seems that things, in a process of change, have a beginning and ending as Plato observed. We know now that any cosmic cycle, like our solar system, has a beginning and end. But even so it does not follow that creation as a whole has a beginning and an end.

The problem of space did not receive the same consideration from St. Augustine and the Schoolmen that the problem of time received. Presumably space as well as time was created with the world. For Erigena space and time are eternal creations because the creative process is eternal. But for the orthodox theologians space as well as time must have originated in the beginning. One difficulty with their treatment of space is that they do not distinguish between place, or location, and space as a universal extensive medium. It is clear that St. Augustine regards places and times as having originated with the creation of the world. He regards places and times as originating together, and belonging together. This hyphenating of space and time was emphasized by Gregory Nazianzene and Erigena. They may be said to have anticipated the recent conception of space-time. But what about space as the universal medium of things? Did this originate in the beginning?

The concept has importance in connection with the omnipresence of God. Is God unlimited in extension? If so, extension would seem to belong to the essence of God. It is difficult to think of God as attaining infinite extension with the creation of the world. If all things depend upon God, then God must be present to all things. St. Augustine makes it clear that when he speaks of the creature as being farther or nearer to God, he is not speaking of a spatial relation—"not so much the farther from Thee as the unliker Thee; for it is not farness of place."[58] God pervades all space. "Thou, therefore, Lord Who art not one in one place, and otherwise in another, but the Self-same . . . didst in the Beginning, which is of Thee, in Thy Wisdom, which was born of Thy own Substance, create something, and that out of nothing." Here it seems clear that space as an extensive medium of things is presupposed. God is the Self-same through-

out space. He is not located in a place. Rather God includes space. "In Him things are, rather than He is in any place."[54] St. Augustine may have suggested to Henry More the idea of identifying the divine Presence with space. Without the created world there would be "no vicissitude of spaces of times",[55] but there might still be universal space.

St. Augustine follows the Platonic tradition in his admiration of astronomy. There are the celestial intelligences which guide the stars and the spheres. And there is the mystical "heaven of heavens"—"some intellectual creature, which although no way co-eternal with Thee, the Trinity, yet partaketh of Thy eternity, and doeth through the sweetness of that most happy contemplation of Thyself, strongly restrain its own unchangeableness."[56] Cleaving close to God, "it is placed beyond all the rolling vicissitudes of times." While St. Augustine follows Aristotle in his hierarchy of dignity of creation, he did not spatialize the relation of creation to God as did St. Thomas and Dante. It is the character of our love which determines our nearness or remoteness from God. The presence of the divine love is alike the joy of the blessed and the pain of the wicked, as the same light may be pleasant or painful.

St. Anselm, in his candid and naïve way, is the most instructive of the Schoolmen in his attempt to conceive the omnipresence of God with reference to space and time. St. Anselm here follows his intuition, which is the outgrowth of his piety, rather than formal logic. God is conceived as a whole-form and not as a mere abstraction of simplicity. It is true that God must not be conceived as made of parts on the analogy of material things. "Rather Thou art unity itself, indivisible by any conception. Therefore life and wisdom and the rest are not parts of thee, but all are one; and each of these is the whole which Thou art, and all the rest are. . . And Thy eternity, which Thou art, is never and nowhere a part of Thee or Thy eternity. But everywhere Thou art as a whole, and Thy eternity exists as a whole and forever."[57] God is inclusive: "Nothing contains Thee, but Thou containest all. . . . Thou dost permeate and embrace all things."[58] This sounds pantheistic. How can God transcend all

things as well as embrace all things? "Is it because they cannot exist at all without Thee; while Thou art in no wise less, if they should return to nothingness?" Another reason is suggested which involves the conception of a realized whole: "In this way also dost Thou transcend all things, even the eternal, because Thy eternity and theirs is present as a whole with Thee; while they have not yet that part of their eternity which is to come, just as they have no longer that which is past? For so Thou dost ever transcend them, since Thou art ever present with Thyself, and since that to which they have not yet come is ever present with Thyself."[59] Reality is complete in God, including what for us is past, present and future. In an eternalistic view of reality, it is an accident of our finite perspective that we do not remember the future.

St. Anselm is committed to the Augustinian view that God is the complete whole of reality, including at once or eternally all that really is, while the finite is dependent and incomplete. But this gives rise to a serious difficulty when St. Anselm tries to understand the relation of the divine whole to the finite parts with their places and times. This difficulty is a real one on any theory, but for St. Anselm it is in part due to the fact that he, like St. Thomas later,[60] regards position in space and in time as a thing. But God cannot be conceived as contained in a place or in a moment of time. He is not in one place or in one moment more than in another. Nor can He be conceived as divided up among places or times, for His life is a whole. God is uncircumscribed, and "uncircumscribed is that which is, as a whole, and at the same time everywhere."[61] In the finite sense, therefore, God is in no place and at no time "for nothing contains Thee, but Thou containest all".[62] God is not limited by places and times. "Everything that is limited by place or time is less than that which no law of place or time limits. Since, then, nothing is greater than Thou, no place or time contains Thee." God must be said to be in no place or time since He is "contained by no other at all." Yet God must be present to-and-in the finite, therefore God "may be said, after a manner of His own, to be in every place or time, since whatever else exists is sus-

tained by His presence, lest it lapse into nothingness".[63] St. Anselm is committed to the monistic position that everything derives its existence from God.

It is easy to understand why the charge of pantheism was brought against him by Roscellinus. It is difficult to see how he can escape this charge. But his perplexity about spaces and times may be avoided by regarding these as relative and variable relations due to our finite frames of reference. They are not absolute partitions of reality, and do not divide the wholeness of reality, if there is such wholeness. But such an interpretation must wait for the theory of relativity in the twentieth century. St. Anselm's sound intuition led him to the conclusion that we must assert that God is everywhere and always. The space and time of God is not partitioned by our perspectives. He is present in his own manner to all the finite centres; and their meaning and salvation depend upon realizing in themselves this Presence, in so far as they are able. The implication in St. Anselm seems to be that God fills universal space and universal time, or is universal space and universal time. At any rate he implies the reality of universal space and universal time.

St. Thomas constructed his great theological system after the controversy between realism and nominalism. The latter had been ruthlessly suppressed by the authority of the Church, but the rift which it created in theological theory remained. The charge of pantheism went home even though repudiated. Pantheism was inherent in the ontological argument, and St. Thomas rejects this argument. In the language of Aristotle, he stressed the efficient cause, rather than the formal immanent cause, in his conception of the relation of God to the world. He accepts as an article of faith the finite creation of the world with its times and places. With St. Augustine he conceives God as immutable and simple. This means that in God there is no time, no place, no variety. Yet he sees no inconsistency in believing that God eternally planned the world with reference to successive realization in time. God's will is determined by His eternal Wisdom in creating the world, but St. Thomas feels no difficulty in this Wisdom setting a finite period of time for creation. Per-

haps the reason that St. Thomas feels no difficulty is that he had created the concept of an infinite "imaginary time", as contrasted with real finite time. But this "imaginary time" is obviously our projection and does not relate to the activity of God which is conceived as timeless.

St. Thomas accepts with St. Augustine the absolute immutability of God, yet St. Thomas assumes that, though God's eternity is "outside of time", yet all time is present at once to God's wisdom. But it is impossible to understand how there can be temporal values present to an "immutable God", especially as those values could not have existed before the finite creation of the world. Eternity as "a simultaneous whole"[364] is outside of time which is not a simultaneous whole. If he had thought of eternity as the structure or meaning of time he might have brought the two together. Sometimes he seems to have been near this conception of eternity: "As therefore the idea of time consists in the numbering of before and after in movement; so likewise in the apprehension of the uniformity of what is outside of movement"[365] eternity is implied. Movement must be excluded from the eternity of God, because time as a finite patch cannot be included in eternity. An "indeterminate time" cannot be included in eternity, for eternity is conceived by St. Thomas as a simultaneous whole outside of time. St. Thomas' attempt to compromise with common sense in this, as in so many other matters, is theoretically unsatisfactory, though it, no doubt, accounts for his practical appeal.

What is the relation of God to space? Having abandoned the ontological argument, with its pantheistic implications, St. Thomas thinks of the relation of God to the world as operational. "A thing is where it works." (Here St. Thomas anticipates Lotze.) God is the efficient cause of all things. With St. Augustine and St. Anselm, he holds that God must be omnipresent, because all things depend upon Him. But it makes a difference whether you conceive this relation ontologically or operationally. "God is in all things as the cause of the being of all things. . . God is above all things by the excellence of His nature; nevertheless, He is in all things as the cause of the being of all

things.'[66] Creation is not with St. Thomas, as with Erigena, a differentiation, somehow, out of a universal concept of being. St. Thomas ostensibly adopts the dynamic view of emanation rather than that of logical and ontological inclusion (which in the end, as we have seen, amounts to logical implication). But God does not create through intermediaries as in Neoplatonism. The creation of God is direct through all the grades. He radiates as the sun but the radiation of the sun is for St. Thomas continuous in quality. It is not degraded in quality, as in Plotinus' conception, but in intensity. God creates everything by His power, but the power and essence of God are not divided. God is present in His own essence in His operations in the finite.

St. Thomas is helped in his conception of the omnipresence of God by his distinction between spiritual inclusiveness and corporeal inclusiveness. "Incorporeal things are in place not by contact of dimensive quantity, as bodies are, but by contact of power.'[67] God is present to the world and includes the world, not as one body contains another, but as the soul contains the body and is present in every part by controlling it. "Although corporeal things are said to be in one another as in that which contains them, nevertheless spiritual things contain those things in which they are, as the soul contains the body. Hence also God is in things as containing them: nevertheless by a certain similitude to corporeal things, it is said that all things are in God; inasmuch as they are contained by Him,'[68] i.e. by operation and control. He compares God's relation to the world with the relation of a king to his subjects. "A king, for example, is said to be in the whole kingdom by his power, although he is not everywhere present.'[69] We must, of course, be careful not to press analogies too far.

If God exists in Himself and is sufficient unto Himself, eternal and immutable, how can He operate at a distance? St. Thomas tells us that nothing can operate at a distance except God. "No action by an agent, however powerful it may be, acts at a distance except through a medium. But it belongs to the great power of God that He acts immediately in all things. Hence

nothing is distant from Him, as if it could be without God in itself. But things are said to be distant from God by the unlikeness to Him in nature and grace; as also He is above all by the excellence of His own nature.'"[70] But since the presence of God in the finite places and times is operational, there is nothing to prevent God from having an absolute locus in space. St. Thomas' Ptolemaic scheme of the universe—with the earth as the centre and the concentric spheres with the stars circulating around it, and above these the Empyrean, and above all, God as the apex—is an absolute scheme of value as well as of astronomy. God is everywhere by His power, but there is a sense in which God's presence is local though that can be revealed only to the Blessed. There is an absolute up and down in the world of values, as in the world in space. The redeemed will ascend, each to his appropriate star. Dante later translated into poetry this astronomical and theological scheme of St. Thomas. There can be no doubt that space is absolute in St. Thomas, though places are created with the world.

While God is present operationally in everything that exists, even the devil, He is not present in the same way everywhere. How He is present depends upon the capacity of the individuals. Even in Paradise there are gradations of happiness, though everyone is satisfied with his lot. God is present in a special way to the rational creature, He is present in a more specific way to those who have received the divine grace, and He is present in an extraordinary way in the spiritual union experienced by the mystic. But God remains distinct, immutable and simple in all the types of presence.

The Order of Creation

In its conception of the order of creation mediaeval theology follows Neoplatonism instead of *Genesis*. The order in the first chapter of *Genesis* is in general from the lower levels to the higher levels of creation and in this respect agrees with the evidence from the ancient rocks. But the order in St. Augustine and his successors is from the higher to the lower. Such a reversal of the accepted authority of *Genesis* is covered up by a free allegorical interpretation. When the commentators get through, the only vestige that remains of *Genesis* is the phrase, "in the beginning." While the theologians follow the Neoplatonic order they introduce modifying interpretations. We have seen that, while for Neoplatonism creation is a spontaneous and unintentional overflow, according to the mediaeval interpretation it purports to be an intentional act. While in Neoplatonism creation is a process of degradation, there is no blame attached to it. The degradation inheres in the nature of emanation. Origen, on the other hand, makes "the Fall" responsible for the variety of the world: "What other cause are we to imagine for so great a diversity in the world, save the diversity and variety in the movements and declensions of those who fell from that primeval unity and harmony in which they were at first created by God, and who, being driven from that state of goodness, and drawn in various directions by the harassing influence of different motives and desires, have changed, according to their different tendencies, the single and undivided goodness of their nature into minds of various sorts."[71] St. Augustine and his successors reject the interpretation by Origen and conceive the plan of creation, with its multiplicity and order, as existing in the mind of God from eternity. The execution of this plan into a spatial-temporal existence is perfect. This conception of creation as a masterpiece by God is beautifully expressed by St. Athanasius: "The all-powerful, all-perfect, and all-holy Word of the Father, descending upon all things and everywhere extending His own energy and bringing to light all things both visible and invisible, knits and welds them into His own being, leaving nothing destitute of His operation. And a certain marvelous and

divine harmony is thus veritably brought to pass by Him." This is the best world, and the fall of man was not allowed to interfere with its perfection. Nature is beautiful, "only man is vile." But the vileness of man in the omniscience of God is made to contribute to the beauty of the picture.

St. Augustine clearly sets forth that the order of creation is from the higher to the lower: "For in all things that God made, and are not of His essence, the living is before the dead; the productive before those that want generation; and in things living, the sensitive before the senseless, as beasts before trees; and in things sensitive, the reasonable before the unreasonable, as man before beasts; and in things reasonable, immortals before mortals, as angels before men, but this is nature's order."[72] St. Augustine manages to introduce the creation of angels and celestial intelligences into the work of the first day by an ingenious interpretation of: "Let there be light" (an interpretation suggested by Aristobulus in the 2nd century B.C.).[73] He thinks that the creation of light includes the angels. He recognizes that it is not so written, but he believes in the existence of angels and celestial intelligences; and they must come into the picture of creation somewhere. He disposes of the order of *Genesis* by allegorical interpretation. Neoplatonism takes precedence over holy writ.

The translation by Erigena of the writings of Pseudo-Dionysius from the original Greek into Latin supplied the Latin mind with new resources for constructing a cosmology. The Dionysian scheme was definitely incorporated into orthodox theology by St. Thomas. Here the Aristotelian conception of continuous gradations in nature finds an elaboration undreamed of by Aristotle. Hierarchies of archangels and angels supply the missing link between God and man. The gradations from man down to matter are taken over from Aristotle. St. Thomas bases his gradations upon Aristotle's distinction of actuality and potentiality, God being pure actuality. Since the radiating light is the light of intelligence, St. Thomas can state these gradations in terms of knowledge. "The angels introduce, between the pure act of God and rational knowledge, resting upon

sense-data, an infinite number of intermediate degrees along which a less and less simple mode of knowing descends, parallel to a being becoming less and less pure act. . . . There is henceforth continuity of order. Order rerum talis esse invenitur ut ab uno extremo ud alterum non pervenitur nisi per media (i.e., the order of nature is continuous from one extreme to the other so that nothing can occur in it except through mediating grades). Through the angels . . . knowledge descends gradually from God, the Source of all light, to man . . . until its ray is finally imprisoned in matter in the form of bare finality,"[74] i.e., sufficient to order the lower part of creation into subservience to the higher.

St. Thomas takes over from Aristotle the identification of the order of dignity with an absolute astronomical hierarchy. In this hierarchy the material earth is at the bottom and God is at the top and between is the stellar world with its concentric spheres in which the stars are set like diamonds. The stellar world is dominated by celestial intelligences. The spatial location of God was made possible by the conception of God as the efficient cause acting at a distance. St. Thomas adopts the metaphor of the sun from Neoplatonism, though he cautions against the limitations of the metaphor, since the sun is not a living creative power. But he is true to the Neoplatonic conception of a genetic descent (which is a thinly disguised logical scheme) from a simple undifferentiated first principle. "In its first principle, this light is one and single, but the further intelligent creatures are removed from the first principle, the more this light is divided and scattered like the rays diverging from a central point. Hence God knows all by His simple and unique essence."[75] In this descent of divine light the intensity of light diminishes with the distance, the lower intellectual substances such as man "being illuminated only by a very feeble and darkened ray of light." Man in this scheme, instead of being just "a little lower than God" (as the Hebrew psalmist has it), is really way down the scale, at least in his mortal state.

The dominance of form over matter determines the rank in the scale. "The nobler a form is, the more it will dominate over

its corporeal matter; the less deeply it is involved in it, the more it surpasses it by its virtue and operation. Thus the forms of the elements, the lowest of all and nearest to matter, perform no operation beyond the qualities of activity and passivity, such as rarefaction and condensation and others of the same order, which seem reducible to the simple dispositions of matter."[76] As we go up the scale there emerges a new dominance, a new quality of the whole, which cannot be reduced to the next lower type. Above the elements of matter "we find mixed bodies, the operation of which is not reducible to those of elementary qualities." The plant souls, the operation of which results in nourishment and growth, are superior to mineral forms. The operations of sensitive souls, possessed by animals, "extend to a certain degree of knowledge, though it is combined to matter and is obtained exclusively by material organs." Human souls exceed animal souls in dignity and control and "are destined to rise above matter by a virtue and operation in which the body has no share." As we proceed up the scale there emerge hierarchies of angelic forms of superior dignity and control, with direct intuition into the principles of things.

If we read creation from below up, we thus seem to have a scale of emergence. This is the way that naturalism interprets nature. But for St. Thomas the scale of emergence, when we pass from the lower to the higher, finds its explanation in an eternal scale of creation from the higher to the lower. St. Thomas believes in miracles but not in the miracle of the materialist that nature can raise itself in the scale by pulling its own bootstraps. It is a beautiful and significant statement by St. Thomas that "everything, which is raised above to what exceeds its nature, must be prepared to some disposition above its nature."[77] This statement is used to show the necessity of grace if we are to rise above the condition of nature to the spiritual life. But for St. Thomas it holds for creation as well as for salvation. St. Thomas was not concerned with the problem of evolution, since creation for him is an eternal act, and its order is from the more perfect to the less perfect. But it is easy to translate St. Thomas' doctrine of gradations with

their emergent qualities into the language of evolution. Perhaps that is the reason that the Catholic Church has adjusted itself so readily to the doctrine of evolution. To those that debase the dignity of man because of his lowly origin, the Catholic Church can reply in the language of St. Thomas: "Changes receive species and dignity not from the term *wherefrom,* but from the term *whereto.*"

The most unsatisfactory part of St. Thomas' graduated scheme of descent is the significance of the individual. St. Thomas interprets Aristotle to mean that matter is the individuating principle, distinguishing the humanity of Socrates and Callias. In that case they are differentiated by their accidents, not by their essence (which is their general human characteristics). According to St. Thomas an angel would be an individual essence, corresponding to humanity since angels have no bodies to distinguish them. His conception of human individuality lands St. Thomas in all sorts of difficulties. If the body individuates man, it must be "determinate matter," predisposed to a particular individuality. Since the causes or reasons of all things must exist in God, it seems that God must both cause and know individuals. "Evidently what flowed from God in things pertained not only to their universal nature, but to their principle of individuation. . . . And as He causes, so He also knows." Aristotle was not concerned with the immortality of the soul. But the immortality of the human soul is an article of faith for St. Thomas. Since the body is destroyed with death, there must be an individual soul which persists. Aristotle maintained that the rational soul is eternal, but that the passive reason passes with the body and with it pass memory and imagination which depend upon the body. St. Thomas follows Plotinus and St. Augustine in insisting upon the unity of the soul. Animal souls are adherent to their bodies and perish with them. But human souls are separable, though after death they cannot come to their full functioning until the resurrection of the body. In the interim they are incomplete substances. But if the body is the principle of individuation, and if the form or essence is merely that of the species, it is not clear how the soul

can be separable from the body. Duns Scotus criticized St. Thomas for the uncertain status he gave the individual, and solved the problem to his own satisfaction by assuming a particular form, a this-form, as well as the form of the species. Individuality is thus conceived as the union of universality and particularity (as in Hegel).

While Catholic theology derived its conception of the order of creation from Neoplatonism, it departed sharply from Neoplatonism in its conception of the relation of the various stages of the hierarchy to one another and to the ultimate source. According to Neoplatonism the highest level in the hierarchy of creation emanated from the One, but in turn every stage generated the next stage. Thus Intelligence (with the Platonic forms) is an emanation from the One, the World Soul is an emanation from Intelligence, and the sensible world is an emanation from the World Soul. Every level generates the level below it. Only the first level of the hierarchy has direct relation with the ultimate source, though all the stages are mediately dependent upon it. Here the Catholic tradition came into conflict with Neoplatonism. In St. Augustine's day Neoplatonism carried on a lively polemic against Christianity; and St. Augustine, who had been a pagan Neoplatonist before he became a Christian, naturally stressed the difference between the Catholic tradition and pagan Neoplatonism. The most serious difference was of course the interpretation of the *Logos* in the two traditions. But the conception of creation was closely bound up with this. St. Augustine affirmed against Neoplatonism that God alone is "the Maker both of the world and all creatures therein, bodies and souls, of which, in earth man, the chief piece, was made alone, after His image."[78] The seminal causes that the angels or we use in producing living things "are the work of none but God."[79] A woman is not the creatrix of her child. Angels are not creators. They are "like husbandmen who tend the vines."[80] The idea that God is a creator of creators is foreign to the mediaeval tradition. Created beings can only imitate. Since God, according to St. Augustine, is the same everywhere He is alike creative everywhere. The relation of the created to the Creator is throughout immediate and direct.

St. Thomas, like St. Augustine, emphasizes that "to create can be the action of God alone."[81] Since St. Thomas adopts the Neoplatonic language of emanation or radiation and conceives of creation as a continuous gradation from the highest to the lowest level, it is necessary for him to emphasize that the levels themselves are not creative (as in pagan Neoplatonism), but that the creative Light of God flows through the whole hierarchy. St. Thomas' conflict is with Arabic Aristotelians like Avicenna and their Neoplatonism. St. Thomas' formalistic conception of creation is here evident. The less universal is derived from the most universal, and that is absolute being. "The more universal effects must be reduced to the more universal and prior causes. Now among all effects the most universal is being itself; and hence it must be the proper effect of the first and most universal cause, and that is God. . . . Now to produce being absolutely, not as this or that being, belongs to creation."

St. Thomas adopts Aristotle's conception of the universal: the universal is immanent in subordinate species and individuals. Being, as the most universal, would then be immanent in all the subdivisions of being. "As an individual man participates in human nature, so every created being participates, so to speak, in the nature of being; for God alone is His own being." This would logically lead to pantheism. From this St. Thomas tries to save himself, as we have seen, by stressing God as the efficient cause, present by His operation to everything. Then everything would not need to be included ontologically in God. It is present in God only as dependent upon His operation and His control. What concerns us here is that God does not create by intermediaries, but radiates through the hierarchy, and thus creates directly. Yet while God creates directly there is a degradation of the quality of creation with the distance from God. St. Thomas is dominated by the metaphor of the sun. The creative energy becomes weaker with the distance. It is a feeble light when it comes to man and is finally lost in matter. To be sure, St. Thomas falls back on St. Augustine that distance merely refers to likeness to God, and he reiterates again and again that the effect of the grace of God depends upon the capacity of the individual. But the capacity too is created; and the hierarchy

of capacity is in general spatial. He is dominated by his spatial metaphor.

That the universe is an organic whole is the heritage of Christian theology from the Platonic tradition. But while, according to Plato, the universe is as perfect as it can be, considering the inertia of matter, in the Catholic interpretation the universe is an absolutely perfect whole. Since God created matter as well as form, the universe is absolutely plastic to the plan of God. Origen again is the mediator between the Christian and the Platonic tradition. While Origen attributes the variety of the world to "the Fall", he is also assured that "God has made this variety count towards one end of perfection, making the differences supplement each other, but safeguarding liberty. Although the whole world is arranged into offices of different kinds, its condition nevertheless is not to be supposed as one of internal discrepancies and discordances; but as one body is provided with many members, and is held together by one soul, so I am of opinion, that the whole world also ought to be regarded as some huge and immense animal, which is kept together by the power and reason of God as by one soul."[82] The followers of Origen are not so explicit in their animism, but they all hold that the world is a perfect organic whole.

St. Augustine, the professor of rhetoric, has a strong aesthetic feeling for nature. I am inclined to think that the aesthetic feeling dominated the thought of St. Augustine. It is this which makes him insist upon a tidy universe, arranged in every detail according to one perfect eternal plan. This makes him ruthless in the treatment of the individual, as is manifest in his doctrine of predestination. There must be nothing indeterminate in his world. Everything is clearly foreseen, or rather seen (for God knows no time) by the Creator from eternity. No individual initiative can bungle the plan. Everything, whether in creation or salvation, derives from one Source. Man had a choice, but the outcome of this is eternally foreseen. The same passion for unity made him reject any dualistic conception of creation. He rejects Platonic dualism, but he is especially antagonistic to the crass dualism of the Manichaeans (from whom he had broken

away), with their opposition of good and evil powers in the universe. "Certain men there be who mislike thy works; and say, that many of them Thou madest, compelled by necessity; such as the fabric of the heavens, and harmony of the stars; and that Thou madest them not of what was Thine, but that they were otherwise and from other sources created, for Thee to bring together and compact and combine, when out of Thy conquered enemies Thou raisedst up the walls of the universe; that they bound by the structure, might not again rebel against Thee."[83] The Manichaeans thought that "other things", not so lofty as the heavens, "like flesh and minute creatures were created by a mind at enmity with God." Such creatures as lice and fleas seemed the work of the devil. They seem to have no place in a tidy universe.

Against the Manichaeans, St. Augustine asserts that the unity and beauty of the universe is the work of one mind, creating out of nothing. Creation must be viewed as the completion of a perfect plan. This is the significance of the days of creation, which is really one act, though staged in days for our better understanding. Six times it says that God made things good but the seventh time very good. "For severally, they were only *good,* but altogether both *good* and *very good.* All beautiful bodies express the same; by reason that a body consisting of members all beautiful, is far more beautiful than the same members by themselves are, by whose well-ordered blending the whole is perfected, notwithstanding that the members severally be also beautiful."[84] Everything is arranged in excellent proportions, number and order, though only when we can see things as blessed spirits can we fully realize this beauty. There is nothing mean in nature. The lowliest things have number and measure as well as the highest. They all have their place in the whole, though we, biased by our interests, may not see it. "It is not the consideration of nature in respect of our profit, but in itself that it glorifies the Creator."[85] It is the will which is degraded, when it is assimilated to the lower levels of creation.

St. Augustine realizes, as no one before him and few after him, the temporal significance of creation. Creation is not mere-

ly a spatial whole but a temporal whole. St. Augustine makes the history of man the basis of the temporal drama which he stages in seven acts or ages. We live in the sixth age—the age of struggle between the city of this world and the City of God. But in the finale, the seventh age, the City of God shall be triumphant and the city of this world shall be consigned to everlasting torment.

The beauty of this world is augmented by God out of contraries. The Fall, so far from spoiling the drama of creation, enhanced it. "For God would never have foreknown vice in any work of His, angel or man, but that He knew in like manner, what good use to put it unto, so making the world's course like a fair poem, more gracious by antithetic figures."[86] St. Augustine feels that the figure of strophe and antistrophe is the most pleasing of figures in poetry. "Thus as those contraries opposed do give the saying an excellent grace, so is the world's beauty composed of contraries, not in figure but in nature." There must be the contrast of light and darkness, of life and death, of good angels and evil angels, saints and sinners, to enhance the beauty of the song of creation. Harmony requires contraries. In this St. Augustine is at one with Heraclitus. We may well question whether beauty always requires contrast. It is certain that contrast does not necessarily produce beauty. But what is important here is that St. Augustine seems indifferent to the tragedy of the individuals who are destined to furnish the dark background. He glories in the mass effect. Everything is unified by the omnipotence and omniscience of God into a perfect whole. The hallelujah chorus of the elect and the deep wail of the eternally damned are harmonized into a grand oratorio. The aesthetic motive triumphs over the ethical. "God is the unchangeable Governor as He is the unchangeable Creator of mutable things, ordering all events in His providence until the beauty of the completed course of time, of which the component parts are the dispensations adapted to each successive age, shall be finished, like the grand melody of some ineffable rare master of song."[87]

St. Thomas, in a prosier manner, brings all the resources of

his learning and thought to demonstrate that creation is a perfect whole. To have an organic whole there must be variety. He rejects Origen's idea that the variety came through the Fall. "The distinction and multitude of things come from the intention of the first agent, who is God." The variety of parts is essential to the scheme of a perfect whole. "For He brought things into being in order that His goodness might be communicated to creatures, and be represented by them, and because His goodness could not be adequately represented by one creature alone, He produced many and diverse creatures, that what was wanting to one in the representation of the divine goodness might be supplied by another. For goodness, which in God is simple and uniform, in creatures is manifold and divided; and hence the whole universe together participates in the divine goodness more perfectly, and represents it better than any single creature whatever."[88] The perfect exemplar is one and "the perfect representation is assimilated to the exemplar and is only one and is multiplied by reason of matter only. Hence the uncreated image, which is perfect, is only one. But no creature represents the first exemplar perfectly, which is the divine essence; and, therefore, it can be represented by many things. Still, according as ideas are called exemplars, the plurality of ideas corresponds in the divine mind to the plurality of things."[89] That is difficult to understand, if the plurality of things (expressing one exemplar) is due to matter. St. Thomas would reply that this concretion of one form into many individuals is part of the intention of the Creator, since matter itself is created. With St. Augustine he holds that form and matter are concreated.

To have a perfect organic whole there must be not merely distinction of things, but there must be inequality of things or degrees of dignity, all subserving one end, and this inequality is also included in the Wisdom of God as cause. "It is part of the best agent to produce what is best in its entirety, but this does not mean that He makes every part of the whole the best absolutely, but in proportion to the whole, in the case of an animal for instance, its goodness would be taken away if every

part of it had the dignity of an eye. Thus, therefore, God also made the universe to be best as a whole, according to the mode of a creature, whereas He did not make each creature best, but one better than another."[90] Every part then, however lowly, is important to the whole. The part can have no quarrel with the whole. It exists for the whole and not the whole for the part. In this insistency upon the need of multiplicity and inequality of parts to constitute an organic whole, St. Thomas follows in the footsteps of Plato and St. Paul.

But St. Thomas goes a step further and maintains that the highest type of universe requires that the parts can fail. "Now one grade of goodness is that of the good which cannot fail. Another grade of goodness is that of the good which can fail in goodness, and this grade is to be found in existence itself. . . . As, therefore, the perfection of the universe requires that there should be not only beings incorruptible, but also corruptible beings; so the perfection of the universe requires that there should be some which can fail in goodness, and thence it follows that sometimes they do fail. Now it is in this that evil consists, namely, in the fact that a thing fails in goodness. Hence it is clear that evil is found in things, as corruption also is found; for corruption itself is an evil."[91] St. Thomas believes that a universe with indeterminacy in it is superior to one in which the parts have no play. "The whole itself, which is the universe of creatures, is all the better and more perfect if some things in it can fail in goodness, and do sometimes fail, God not preventing this."[92]

St. Thomas tried to humanize the theology of St. Augustine. He is concerned to save the freedom of the individual. And freedom for St. Thomas is not the mere absence from outward restraint; it is absolute or arbitrary freedom. He is a real indeterminist. It is true that St. Thomas holds that the idea of the good or apparent good determines the action. But it is not determined that we shall attend to the idea. "If the will performs its action while the intellect thinks of the beatitude, the action will be necessarily determined by its object. The will would not wish for any other. But the exercise of the act

remains free. If we can not not-will the beatitude while thinking of it, we can yet will not to think of the beatitude; the will remains mistress of its act and can use it as it likes with reference to any object."[93] William James did not improve upon this analysis. For St. Thomas, as for James, the problem of free will is ultimately one of attention. Though we act upon the idea to which we attend, attention itself is not absolutely determined. Virtuous habits are important, but we are not the creatures of habit. We can choose between habits. St. Thomas, like James, recognizes pluralism and contingency in our world. The divine radiance breaks upon a multiplicity of individuals and these respond according to their capacity and willingness.

But St. Thomas is handicapped in working out his theory by the tradition which is authorized by the Church. St. Augustine was successful in fastening upon the Church the dogma that man in his fallen state is incapable of all initiative towards salvation. St. Thomas follows the tradition in holding that the preparation for divine grace must come from above. "For neither does this happen otherwise than by divine help."[94] The initiative of election must come from God. And with St. Anselm he feels that there is no injustice in predestination, since salvation is a divine gift. But St. Thomas tries courageously to reconcile predestination with free will. Free will is "traced to God as cause." It is part of predestination. "The order of predestination is certain; yet free will is not destroyed; whence the effect of predestination has its contingency."[95] The number of the elect is certain. But "anyone may lose his crown by mortal sin. Another person receives that crown thus lost, inasmuch as he takes the former's place. For God does not permit some to fall without raising others."[96] St. Thomas recognizes that he is on slippery ground. He therefore in the next paragraph goes on to say: "Although it is possible for one who is predestinated, considered in himself, to die in mortal sin; yet it is not possible if supposed, as in fact it is supposed, that he is predestinated." St. Thomas was, no doubt, inclined to conditional predestination, but he also reverenced tradition. The Church in practice has always proceeded upon the basis of con-

ditional predestination, i.e. that all that shall turn to the Church in penitence and accept the means of salvation will be saved. It has not limited the number, but extended the invitation universally. In this respect the Church has been true to its Founder who said: "Come unto Me all ye that labor and are heavy laden and I will give you rest," and who found the only obstacle in that "ye would not."

St. Thomas tries to find a place for freedom in his distinction between primary causes, which are in the mind of God and which are absolute, and secondary causes which have an element of contingency. There is not only one line of causality, at least in creatures with reason and freedom. The end is determined, i.e. that everything shall minister to a perfect whole. But the means are not absolutely predetermined. "One who provides universally allows some little defect to remain, lest the good of the whole should be hindered. . . . Since God, then, provides universally for all being, it belongs to His providence to permit certain defects in particular effects, that the perfect good in the universe may not be hindered, for if all evil were prevented, much good would be absent from the universe. A lion would cease to live, if there were no slaying of animals; and there would be no patience of martyrs if there were no tyrannical persecutions."[97] God, being almighty, can always turn evil into good in His providence. "God, however, extends His providence over the just in a certain more excellent way than over the wicked; inasmuch as He prevents anything happening which would impede their salvation." Yet the elect "may lose their crown through mortal sin." This cannot be part of predestination.

To a rational creature something is imputed "as a fault or as a merit and there is given it accordingly something by way of punishment or reward." But how can this be, unless their will is absolutely a determining factor? It is part of the order of predestination that people shall help towards salvation, "whether it be one's own prayers or those of another; or other good works, and such like, without which one cannot attain to salvation."[98] This is not "on account of any defect in the power of God, but because He employs intermediary causes, in order that

the beauty of order may be preserved in the universe; and also that He may communicate to creatures the dignity of causality." But such "dignity of causality" must mean real initiative on the part of individuals.

If there is real indeterminism, does this limit the omniscience of God? Such a conclusion could not be tolerated, for the absolute omniscience of God is assumed. Contingency may be (as suggested by Aristotle) a fact as between particular orders of causation, "but if we regard the universal cause, outside whose range no effect can happen, it is said to be foreseen. Thus, for instance, the meeting of two servants, although to them it appears as a chance circumstance, has been fully foreseen by their master, who has purposely sent them to meet at the one place, in such a way that the one knows not about the other."[99] According to this reasoning, indeterminism in the finite sphere is only another name for ignorance. St. Thomas saves omniscience, but loses freedom in the absolute sense. Omniscience means determinism and cannot be reconciled with real contingency.

St. Thomas tries to show that predestination is in accordance with nature. "The reason of the quantity of any one part must be judged from the proportion of that part to the whole. Thus in God the reason why He has made so many stars, or so many species of things, or predestined so many, is according to the proportion of the principle parts to the good of the universe."[100] There must be a law of the whole which somehow controls the proportion of parts for the greater development within the whole. Else were nature a mere game of chance. If we now consider human life, we find that what is excellent is rare. "The good that is proportionate to the common state of nature is to be found in the majority; and is wanting in the minority. The good that exceeds the common state of nature is to be found in the minority, and is wanting in the majority. Thus it is clear that the majority of men have a sufficient knowledge for the guidance of life; and those that have not that knowledge are said to be half-witted or foolish; but they who attain to a profound knowledge of things intelligible are a very small minority in respect to the rest. Since their eternal happiness, which consists in the vision of God, exceeds the common state of nature,

and especially in so far as this is deprived of grace through the corruption of original sin, those who are saved are in the minority. In this, especially, however, appears the mercy of God, that He has chosen some for that salvation, from which very many in accordance with the common course and tendency of nature fall short.''[101] This type of selection would seem to limit salvation to the few philosophers who are Catholic saints.

St. Thomas' theology lacks the clearness and consistency of that of St. Augustine. But that is because he tried to square his theology with the needs of human experience. The human mind has a strong intellectual and aesthetic demand for unity and coherence in its world. This demand is expressed in the monism of St. Augustine. But the human mind also must recognize the demand for initiative and freedom; or life loses all moral significance. St. Thomas recognizes this demand. But he also reveres and accepts the demand for unity, expressed in the divine attributes of omnipotence and omniscience. He feels that both demands must stand, and he believes that they are ultimately consistent, though logic naturally tips the scale for unity and loses the equally significant pluralism. His pious mistake is that he believes it possible to build an ultimate theology on traditional assumptions which themselves are inconsistent. But his intuition is sound. If we are to understand our world, we must proceed from the faith that somehow there is unity and meaning in our world, yet hold fast to the plain deliverance of experience that this is a pluralistic world in which parts can and do fail. In some way a pervasive and guiding providence brings order out of chaos, but we are part of that providence and must recognize our responsibility. The prevailing harmony will be different for our efforts. Else we have no responsibility. This the Church has always recognized in practice, however confused it may have been in theory.

Whatever the limitations of the great Catholic mystics in theory, they felt profoundly the presence of God in nature. Hugo of St. Victor goes into ecstasy over the revelations of the beauty of God in nature. ''The divine spirit'', says John of Salisbury, ''the creator and giver of life, replenishes not only the human soul but every creature in the universe.... All things,

even the most insignificant, reveal God, but each reveals Him in its own way. Just as the sunlight is different in the sapphire, the hyacinth, and the topaz, so, too, God reveals Himself in an infinite variety of forms in different orders of creation." In the most Christ-like of the mediaeval mystics, St. Francis of Assisi, this feeling for the presence of the divine in nature and man becomes a companionship of infinite tenderness which his own beautiful words best express:

"Most High, omnipotent, Good Lord, thine is the praise, the glory, the honour and every benediction;

To thee alone, Most High, these do belong, and no man is worthy to name thee.

Praised be Thou, my Lord, with all Thy creatures, especially my Lord Brother Sun that dawns and lightens us;

And he, beautiful and radiant with great splendour, signifies Thee, Most High.

Be praised, my Lord, for Sister Moon and the stars that thou hast made bright and precious and beautiful.

Be praised, my Lord, for Brother Wind, and for the air and cloud and the clear sky and for all weathers through which thou givest sustenance to thy creatures.

Be praised, my Lord, for Sister Water, that is very useful and humble and precious and chaste.

Be praised, my Lord, for Brother Fire, through whom thou dost illumine the night, and comely is he and glad and bold and strong.

Be praised, my Lord, for Sister, Our Mother Earth, that doth cherish and keep us, and produces various fruits with coloured flowers and the grass.

Be praised, my Lord, for those who forgive for love of thee, and endure sickness and tribulation; blessed are they who endure in peace; for by thee, Most High, shall they be crowned.

Be praised, my Lord, for our bodily death, from which no living man can escape; woe unto those who die in mortal sin. Blessed are they that have found thy most holy will, for the second death shall do them no hurt.

Praise and bless my Lord, and render thanks, and serve Him with great humility."[102]

Some Critical Reflections

I regard it as a tragedy that Christian theology foresook the sound intuition of the prophets of Israel and of Plato that this is a dualistic and pluralistic world. There is goodness and beauty in it, but there is also much chaos both around us and in our own lives. We are conscious of the divine Spirit brooding benignantly over this partial chaos inspiring us to work for order and harmony. All is not right with the world, but with the grace of God we can in a measure re-create the world into something nobler and more beautiful. And whatever may be our success we shall thus save our souls by coming into rapport with the universal creative Spirit which works for goodness and beauty. We cannot, as Plato so clearly realized, comprehend this Spirit which works in the large through all time and space. His attributes can have meaning for us only as we strive in piety to realize the divine inspiration in our lives. And then we grasp the meaning of God only under our limitations from our human perspectives. We may hope that our idea of God may become more adequate as our experience enlarges. But at best God can only reveal himself to us in terms of our experience in our historic setting. And the revelation that comes to us is to cooperate with God to bring form and order into the world as it is. God calls on us to become creators, to make the world new and in that sense to bring something into being which was not there before. Creation as we know it in our human experience is a transformation of what is. It is the inspired effort to incarnate eternity in the flux of time. All those that work for the regeneration of the world must recognize that ours is a pluralistic world which offers inertia to any higher pattern of conduct. To say that God made the world such, is saying no more (as Bishop Butler pointed out) than that the world is such. And to attribute the evil of the world to a plan of God's is, to the ethically minded, nothing short of blasphemous. In approaching the mystery of the universe, we must follow the intuitions born of human needs rather than *a priori* assumptions.

It is easy to see how the monistic doctrine, i.e., the doctrine of creation out of nothing, arose historically. It had, no doubt,

its historical justification as an offset to Manichaean dualism which would have been fatal to the development of Christianity. But the consequences of the monistic doctrine are none the less tragic. Its logical offspring is the doctrine of predestination with its absolute fatalism which robs human life of all its moral significance. This tragedy is the result of abandoning the sound intuitions of human experience upon which the prophets of Israel and Plato built their religious view of the universe. The church would speak with the wisdom of God while really it has as its authority only the interpretations by human thinkers and mostly second-rate thinkers at that. No sanction by the most powerful institution that ever existed can raise the faltering and confused efforts of human minds into divine wisdom. The wiser course is that pursued by the great creative geniuses—the prophets of Israel and Plato—who started from human experience and tried to discover a religious theory that would meet human needs.

We cannot presume to understand the ultimate mystery of the universe. We must piece out our limited experience as best we can; and the world of our experience is dualistic and pluralistic. The sound intuition of man refuses to believe that whatever is, is right. There is evil to overcome. The call comes to the individual: "Choose ye this day whom ye will serve." Individual willingness is at the bottom of the problem of making the world in which we live a better world. It is not necessary to assume an absolute metaphysical dualism of good and evil. The problem, as St. Augustine clearly saw, lies in the will. "No inferior thing depraves the will, but the will depraves itself by following inferior things inordinately."[103] Evil is relative. There is no absolutely evil matter or evil soul. There is blindness, ignorance, bad habits. Plato's conviction that the evils among mankind are due to bad education and bad hygiene lies at the bottom of social reform. The right education and the right hygiene will bring about the right humanity. But this involves the right sort of social environment. We must work in devotion, as we see the light, to create a better social order. In the meantime there is the inertia of the individual to be over-

come in order to bring him into a higher pattern. This is true of electrons and of men. Cosmic laziness lies at the root of evil.

In practice, the Church has always been dualistic and pluralistic. It has tried, according to its light, to transform things as they are into an ideal order. It has appealed to individuals; it has tried to bring education—emotional, intellectual and physical—to bear upon them in order to integrate them into a spiritual community under the fatherhood of God and the brotherhood of Man. But since after all it is human and fallible, it has been confused in its aim and methods.

The monistic theory of creation raised two insolvable problems. It removed creation from the realm of the reasonable which can be explored by the methods of science, and put it in the field of magic. It was sufficient for St. Augustine and the Mediaeval Church to say that creation is a miracle; and miracles must be taken on authority. When the human mind proceeds from the analogies of experience, on the basis of empirical method, there is hope that it may understand the universe better. An age which raises tradition to divine authority is naturally antagonistic to scientific discovery. There was a great deal of theorizing about creation in the Middle Ages, but its only test was the agreement with accepted assumptions. At the end of the Middle Ages the subject of Creation was included within the magic circle of mysticism.

But the monistic theory raised another problem which is practically more serious. It robbed man of initiative and responsibility. It made him a mere pawn in the eternal game of the Almighty. Everything happens in accordance with God's foreknowledge. The attempt to introduce indeterminism into such a scheme was fatal to its logic. St. Thomas thought of man's will as having the power of arbitrary choice. But how could such a choice be included in the eternal scheme of God? St. Thomas is satisfied that God can convert evil into good, but in such a case God would have to act after the fact. His prescience would deal with probabilities, for all of which He, no doubt, would be prepared. But on the monistic theory, which St. Thomas accepts, all events must be present at once in the omniscience of

God. Such could be the case only in a deterministic world. God's plan knows of no variation. In the language of St. Augustine, "He does not foresee things to come as we do . . . He sees them not by change of thought but immutably, be they past or not." Such a foresight is implied in absolute omniscience, as St. Augustine clearly saw.

The problem of evil* becomes inscrutable on the monistic theory. If everything happens according to the eternal foreknowledge and act of the Creator, the responsibility for evil recoils upon God. The fall of angels and of Man was foreseen by God and incorporated eternally into the plan. St. Augustine falls back for justification upon light and shadow, upon opposition in poetry and music. But this is an aesthetic and not a moral justification. No one (outside of pantheistic poetry) has had the audacity to identify God with the slayer and the slain. Hideous murders, including collective murders as well as individual murders, affect mostly the innocent. And there are crimes even more hideous than murder. Did God eternally foreknow them and include them in his unalterable plan? What man with sound instincts could worship such a God? Others beside John Stuart Mill have felt that they would rather go to hell than worship such a God. We do not pretend to a transcendental knowledge of God, but in our human way we cannot help feeling that there is something radically wrong with a theology which has created such a God. "Shall not the judge of all the earth do right?" This is the feeling of the Scriptures and of Plato.

The problem of physical evil is as dark on the monistic theory as that of moral evil. Does God send earthquakes, tornadoes, volcanic eruptions, floods and droughts, pestilence and famine, indiscriminately on the good and on the bad? By means of human science and practical cooperation we have succeeded in mitigating these evils, arising from the pluralistic forces of nature, and in the course of time we may practically eliminate them. But has God brought on us these disasters? A pluralistic view of the universe saves us from such monstrous implications.

* For a beautiful, lucid and comprehensive exposition of the problem of evil see *The Nature of Evil*, Radoslav A. Tsanoff, Macmillan, 1931.

The monistic theories have been so intent upon complimenting God with what they conceive as omnipotence and omniscience that they have sacrificed the ethical attributes of God—His goodness and justice. Whatever guise monism may take, it cannot escape the implication that reality is poisoned at the fount. But can we be sure that what we eulogistically conceive as omnipotence and omniscience have any meaning as applied to God? They are rhetoric so far as we are concerned. But that there is a power working for truth, righteousness and beauty, potent to construct and to heal, is the great inspiration of all who work for the realization of ideals in a struggling, pluralistic world. One way out for the monist is to deny the existence of evil, and to maintain that the world is really perfect and that what we call evil is an illusion. But why the illusion of evil in such a world? Why the crying need for salvation which is the deepest note in all the great religions? The trouble with theology has been that it has projected its muddle-headed thinking into the universe.

I have limited myself to Catholic theology, and I may have seemed to be unduly critical of it. But the great masters of Catholic theology have given Christianity the only systematic body of doctrine it has had up to date. Protestantism originated another form of polity, but it originated no theology. The theology of the new era remains to be formulated; and when it comes it must incorporate the profound insights, as well as learn from the failures, of fourteen centuries of hard thinking about ultimate problems. So far the chief lesson we have learned, if we have learned any, is that of our human limitations.

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17. *Ibid.,* XI. 27.
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19. *Ibid.,* XV. 24.
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21. *Ibid.,* XII. 1.
22. *Ibid.,* IX. 12.
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25. Translation by Edward B. Pusey.
26. *City of God,* XI. 25.
27. *Ibid.,* IX. 12.
28. *Ibid.,* X. 10.
29. *Ibid.,* XI. 17.
30. *Ibid.,* XI. 16.
31. *Ibid.,* X. 21.
32. *Confessions,* XI. 9.
33. *Ibid.,* XI. 12.
34. *City of God,* X. 30.
35. *Ibid.,* X. 31.
36. *Ibid.,* X. 26.
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41. *Ibid.,* Cp. Pt. 1, Q. 44, Art. 1.
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65. *Ibid.*, Pt. I., Q. 10, Art. 1.
66. *Ibid.*, Pt. I., Q. 8, Art. 1.
67. *Ibid.*, Pt. I., Q. 8, Art. 2.
68. *Ibid.*, Pt. I., Q. 8, Art. 1.
69. *Ibid.*, Pt. I., Q. 8, Art. 3.
70. *Ibid.*, Pt. I., Q. 8, Art. 1.
71. *De Principiis*, Bk. II, Ch. 1, par. 1.
72. *City of God*, X. 16.
73. On Aristobulus see *The Platonism of Philo Judaeus*, T. H. Billings.
74. *The Philosophy of St. Thomas Aquinas*, E. Gilson, 1924, p. 157.
75. *Ibid.*, pp. 198, 199.
76. *Ibid.*, p. 171. The quotations in the remainder of the paragraph are from the same place.
77. *Summa Theologica*, Pt. I., Q. 12, Art. 5.
78. *City of God*, XI. 26.
79. *Ibid.*, XI. 25.
80. *Ibid.*, XI. 24.
81. *Summa Theologica*, Pt. I., Q. 24, Art. 5.
82. *De Principiis*, Bk. IV, Ch. 1, par. 3.
83. *Confessions*, XIII. 43.
84. *Ibid.*, XIII. 47.
85. *City of God*, XI. 4.
86. *Ibid.*, X. 18.
87. *Epist.* 138 to Marcellinus.
88. *Summa Theologica*, Pt. I., Q. 47, Art. 1.
89. *Ibid.*, Pt. I, Q. 42, Art. 2.
90. *Ibid.*, Pt. I, Q. 47, Art. 2.
91. *Ibid.*, Pt. I, Q. 48, Art. 2.
92. *Ibid.*
93. *The Philosophy of St. Thomas Aquinas*, E. Gilson, p. 232.
94. *Summa Theologica*, Pt. I, Q. 23, Art. 5.
95. *Ibid.*, Pt. I, Q. 23, Art. 6.
96. *Ibid.*
97. *Ibid.*, Pt. I., Q. 22, Art. 2.
98. *Ibid.*, Pt. I., Q. 23, Art. 8.
99. *Ibid.*, Pt. I, Q. 22, Art. 2.
100. *Ibid.*, Pt. I., Q. 23, Art. 7.
101. *Ibid.*
102. *The Lauds or the Canticle of the Brother Sun*, trans., H. Osborn Taylor, *The Mediaeval Mind*, Vol. I, pp. 455-56.
103. *City of God*, XI. 6.

Chapter 11

CREATION AND EVOLUTION

Theories must account for the facts as we find them—a world process in which levels of structure can be discovered and which, in our earthly history at any rate, has arrived in a few instances at creative intelligence and ideals. Speculatively we are tempted to go back to some absolute beginning. But science does not indicate any absolute beginnings. We know only local or relative beginnings. We always live in "middles," as Robert Frost says. The cosmos as a whole never began. Its constitution is constant. That is what we mean by the uniformity of nature. It is our faith in the constancy of the structure of nature that inspires our venture to decipher the past and the future from the moment of history in which we live. But our interpretation can have validity only in so far as the conditions of nature, as we are acquainted with them in our experience, can be projected backward and forward in the stream of history. When theory goes beyond experience, it belongs to the world of fiction, albeit useful fiction if it leads to further experience. I have previously discussed three views of evolution: (1) mere temporal emergence, which means a passage from the lower to the higher without formal guidance, (2) preformation, according to which all the forms and levels are present in the process from the beginning, and finally (3) creation, by which is meant emergence with guidance. Both emergence and preformation deal with evolution as a one-way process. In neither case do we have an adequate rationale of evolution as we know it. It is infinitely improbable, in the face of the evidence, that the evolutionary process should be the result of accidental combinations of mechanical entities. It is equally improbable, in the face of the evidence, to think of all the forms and levels which emerge in evolution as latent in the simplest beginnings and only waiting to be staged.

Both theories are too particularistic in their approach to the

problem. Materialism views the process as the external combination of entities. It neglects the truth emphasized by modern science that entities exist only within fields, that they must be understood in relation to the structure of these fields and finally in relation to the structure of the field of the whole. The preformation theory is also particularistic. It views evolution as one life history, unfolding independently of the environment. It has never given an adequate account of the function of matter in evolution. Bergson has made the impingement of life upon matter the cause of the dissociation of the inherent potencies of the vital impulse, but has at the same time denied the reality of matter. The advocates of preformation have generally taken the particular life forms or entelechies for granted, without trying to account for their origin. When preformism is thoroughly pantheistic, we have seen that, as an evolutionary theory, it becomes indistinguishable from materialistic emergence, as is illustrated in Feuerbach. Both are different descriptive names for the same series of facts. When, on the other hand, preformism takes on the form of transcendental spiritualism, as in the German movement which followed Kant, and denies the reality of space, time, causality and metaphysical plurality, it also denies the reality of evolution, making it the mere appearance of an eternal absolute—which is nonsense. Materialistic emergence and preformation are both local points of view. They regard the history of our earth in isolation from the cosmos. Monistic spiritualism has in general taken an anthropomorphic point of view, and the particular philosopher has proceeded to model the absolute in the image of himself. Neither emergence nor preformation can be true by itself, and both cannot be true since each affirms what the other denies.

We have also examined the orthodox theory of creation out of nothing at a finite time. Such a dogma lies outside the field of a rational philosophy. Human reason must proceed from the known to explore the unknown. In the world in which we live, creation means transformation. We have no experience of calling things into being out of absolute nothing, though we have experience of new things coming into existence from things that

are different. The world process, as we know it, is a process of gradual transformation from simpler organizations to more complex organizations. The process of creation, moreover, must be an eternal process, though locally there are beginnings and endings. It matters not how far we push an absolute beginning into the past, it is equally unintelligible to reason. The forces that are now at work to make a world must always have been at work. We cannot conceive a creator who does not create, any more than we can conceive creation out of nothing. In order to have knowledge, however meagre, we must proceed from the analogies of experience. The rational mind cannot just accept the world as a miracle.

The theory of creation, which I propose, recognizes the aspect of truth in the preceding theories. It recognizes the emergence of real novelties in the local history—new events, forms and levels, which are probably not matched in detail anywhere else. But in contrast to materialism, it holds that events run their course within wholes; and these exist within a universal whole which is compresent with the events and guides the events. With the preformation theory, it recognizes the reality of structure as guiding the individual history. But in contrast to the preformation theory, it holds that structure in particular histories emerges under the guidance of the whole, and is not latent from the beginning in the particular history. It agrees with the traditional theory of creation that the universe cannot be understood without creative genius. This is the immortal insight of the first chapter of *Genesis*. But unlike the later tradition, it does not fall back on magic.

Our account of creation must start with the evidence from the perspective where we are in history. Nature, as we now conceive it, consists of pulses of energy—quanta of radiation, positive and negative electric charges—within an electromagnetic field and a gravitational field. These pulses of energy are integrated into a series of patterns and levels from the comparatively formless type of nebulae to the appearance, in our geological history, of life with its radiations and gradations, culminating in the mind-endowed organism of man. We know that

any part of the cosmos, such as our earth, is a history with a beginning and an end. We know that our solar system is one of an immensity of star systems which, so far as we can ascertain, pass through an analogous history. But within any history the significant thing is the organization of matter into patterns in an ascending series of levels; and this requires a guiding field, the brooding of divine Genius. We require Genius as well as matter in order to understand the advance of nature.

In order for cosmic evolution to be real, and not a mere finite illusion, space and time must be real, there must be a plurality of fields of energy, and these must take account of one another—move with reference to one another—throughout cosmic space, and they must take account of one another in terms of their own unique history and inertia. But above all there must be a cosmic control within which the re-arrangements are guided, so far as the history and inertia of the various centres and milieux of centres permit. Such a process of synthesis by interaction of parts within a whole, I call creation, in contrast with emergence and preformation; and it will be seen that this concept of creation incorporates whatever there is of significance in the emphases of theories of emergence and preformation.

It is impossible here to explain in detail the principles thus assumed.[1] It is sufficient that in some sense they are implied in reality as we know it. I may say that by space I do not mean the units by means of which we measure distances. The units are secondary constructions for the sake of practical convenience. Space does not consist of yardsticks or meters or fractions of these. By space I mean, as the physicist and astronomers do, the ultimate medium within which all energies move, whether radiant energies or material energies, if these are distinct types. This medium is not made up of parts with their motion and inertia. It is an absolute continuum. It has no mechanical or kinematical properties. By time I mean the principle[2] which is

[1] For a fuller account see the author's *Cosmic Evolution*, Macmillan, 1925.

[2] I have always maintained the substantival character of time as well as of space. This conception seems to find confirmation in the cosmic constant λ which recently has figured in the theories of Einstein, Weyl,

manifest in the passage of events in nature, as contrasted with the static character which some things appear to our senses to possess. There is really nothing static in nature. Everything is in transition. The rhythmic periods in nature have, from time immemorial, been the basis of measurements of time. But the measurements of the passage of temporal processes are not time any more than the bushel measure with which we measure oats is oats. The confusion of our quantitative measurements of space and time with space and time has been at the basis of all the arguments for the ideality of space and time, and of all the absurd antinomies from Zeno to the present time.

The detailed definition of the pluralism of the physical world must be left to science. Science finds certain units of material energy and certain units of radiant energy which furnish the constants in its equations of nature-in-transition. Physics has reduced matter to electrons and protons—negative and positive charges of electricity. Whether these may not have to be analyzed into simpler units for certain purposes, scientific experimentation must determine. The evidence indicates that the cosmos is a synthesis of energies which have their individual motions and inertia, and that the structures, made up of these entities, have their individual motions and inertia. These entities are aware of one another and of the distances and masses in the milieux within which the entities move. The mechanisms of this awareness vary with the complexity of organization and degrees of adjustment, but the awareness is universal. By structure I have reference to arrangement into spatio-temporal patterns of the energies of nature. The arrangement is never merely spatial, but temporal as well. It has reference not merely to the simultaneous ensemble, but to the past and future as well. Spiritual behavior, i.e. behavior with mental quality, as well as mechanical behavior, must be understood with reference to these five attributes[1] and in the last analysis all organization is spiritual.

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and Eddington. The constant λ, according to Einstein, is a principle of disintegration or dispersion.

[1] See the author's *A Realistic Universe*, Macmillan, 1916, revised 1931, for a discussion of the five attributes.

In the interpretation of evolution, we must make use of the evidence now available and build out its implications as best we can into the past and the future; and we must by creative imagination attempt to envisage the history of any part in relation to other parts and to reality as a whole. In the world, as we know it, matter and energy exist at various levels of organization. In our local history, these structures appear to sustain a genetic relation to one another. Higher levels appear to emerge from lower levels. Science is a description of such emergence and its local conditions. But whatever may be the convenience of science, we must ever bear in mind that such a view of evolution is a local point of view, and science itself is awakening to this fact. There are an indefinite number of local histories with their local conditions. These histories are real, but they are not self-explanatory. They run their course within the control of the whole. Hence they are bound together by similarities, so far as we are able to observe them. The material out of which the cosmic structure is built is the same everywhere. And the patterns in the evolution of matter are the same everywhere. The spectroscope reveals the same types of matter in far distant stars as on our earth. There is, further, a law of proportion in the emergence of the atoms. This proportion has reference to the future in furnishing the conditions for further development.

Everywhere in nature we have evidence of control. The spiral nebulae seem to pass through similar cycles of evolution; and the stages of stellar evolution are everywhere analogous, within the limits of our observation. A cross-section of the universe, within our observation, shows the various local histories in all possible stages from globular nebulae through various degrees of integration and luminosity to white dwarfs. The beginning and the end of the cycle of stellar evolution is still veiled in mystery. We have only conjectures of the evolution of stars from nebulae and of the transformation of stars into nebulae, but the cycle completes itself, somehow, in spite of our ignorance. Within the span of these vast cosmic cycles the process of organization takes place; and it is the organization, and not the fire-works, which is of supreme interest to us. Here and

there, in the vastness of space, on some obscure satellite of a flaming star the conditions of nature become favorable for such constructive processes as we can observe upon our earth. And the conditions, immensely complicated as they are, which make life and mind possible, manifest the control of nature to a far higher degree than the similarities of the units and structure of energy on the material level of nature. If nature in the large seems prodigal in producing such a vast display of energies for such quantitatevly small results, we have only to watch nature's prodigality in producing thousands of seeds that one flower may become fructified. After all it is not quantity but quality which counts, and it is the small voice of constructive activity which gives us the message of the real genius of nature rather than the shining cauldrons of burning matter. These are but instrumental to the work of constructive synthesis.

Everywhere there is measure, order and proportion, to use the language of Plato. We are spectators—though creative and not merely passive spectators—of the great order of nature. Through creative mind we discover the laws of nature; we do not arbitrarily make them. Everywhere we see the marks of the ceaseless creativeness of Genius, however incapable we are of tracing the process in detail. This cosmic control does not evolve, but everything evolves within it. There is no beginning or end of the creative process. There are only local beginnings and local endings of local histories. In one of these histories we find ourselves, looking backward and forward, peering into the vastnesses beyond our local scene and with supreme audacity trying to form some conjecture of the plan of the whole and of our destiny within it. Though we are part of the cosmic process and though the stage of our activity is set within it, we are also, as creative minds, part of a spiritual order which transcends the cosmic cycles and within which the cosmic cycles run their course. It is within the economy of this spiritual order that we have our ultimate significance. The laws of this spiritual order we can adumbrate only feebly in our little earthly life. But we may feel assured that the law of continuity, which we find within the limited field which is open to our observation, holds in

the vastness of the overlapping spiritual realm, as it holds within the material cosmic processes open to our observation. Here we are concerned with the evolution of nature as we know it from our perspective, and we must try to divine the cosmic genius which is revealed within it.

In trying to understand evolution, the tendency has been to fix the attention on certain speculative beginnings and to let the outcome or, as Aristotle would say, the actuality hang in the air, as it were, as an accident of the supposed beginning. On the contrary, the outcome up to date in our local history is something of which we have first-hand knowledge, and our theories of the beginnings and of the nature of the evolutionary process should be framed to account for the outcome. If mind-endowed beings are the outcome, the evolutionary process which produces such beings cannot be irrelevant to their existence. As Borden P. Bowne so eloquently puts it: "Man and Mind are a part and outcome of the universe, and any explanation which left them out would miss one of its greatest wonders."[1] For us this outcome is naturally the greatest wonder. That the outcome of a process is more significant of the nature of the process than its apparent beginning was well stated by St. Thomas Aquinas: "Changes receive species and dignity, not from the term *wherefrom,* but from the term *whereto.* Therefore a change is more perfect and excellent when the term whereto of the change is more noble and excellent although the term wherefrom, corresponding to the term whereto, may be more imperfect."[2] St. Thomas argues from this that generation is nobler than alteration and creation than generation.

What concerns us here is that the factors, which are assumed in a theory of evolution, must be adequate to its outcome. If the outcome is the capacity for thought and appreciation, the factors of evolution must be sufficient to account for such an outcome. It is contrary to evidence that reflective thought is present throughout the stages of the local evolutionary process; there must therefore be a cooperative factor, which is not stat-

[1] *Theism,* p. 120.
[2] *Summa Theologica,* Pt. I, Sec. 45, Art. 2.

able in terms of the material beginnings, in order to account for the emergence of mind as we know it in man. The fact that all types of theories—materialistic, idealistic, sceptical—imply as a postulate, albeit often an unconscious postulate, that the laws of thought are the laws of things, shows that thought cannot be foreign to the world of things and therefore that its emergence can be no accident. Our theory of evolution must be adequate to account for the relevance of thought. Else the theory and the theorizer are alike proved mad.

There is today universal agreement that the key to cosmic evolution is organization. The matter or stuff of the process manifests different characteristics because of the organization. To say that the new manifestations—laws, events, qualities, levels, individuals—emerge from the organizations of the stuff of nature, is true enough. But how shall we account for the organizations? To say that they emerge is merely to say that they happen. Do they happen by chance? To say that they happen when the adequate conditions are present is a truism. The question is what conditions must we postulate as adequate to account for the progressive series of organizations, the outcome of which is the mind of man. You cannot explain the conditions and their outcome by falling back merely upon antecedent conditions in the local history. For the antecedent conditions do not explain the new organization. As Hume so well expresses it in his *Treatise on Human Nature*: "An object which exists for any time in its full perfection without any effect, is not the sole cause of that effect; but requires to be assisted by some other principle, which may forward its influence and operation." This "other principle" is what we must discover in progressive evolution where new and more complex organizations, with their characteristic qualities, are built out of simpler past organizations. This holds at any stage of the process and not merely at the local beginning of a cosmic history. The rationale of the advance cannot be found merely in the antecedents of the particular history. The environment must ultimately furnish the impetus to advance and suggest the pattern. As Walt Whitman sings:

Urge and urge and urge
Always the procreant urge of the world.

The question is what must be the character of the environment to account for the advance of nature, including the local history of which we are a part—the history of our earth with all that it includes. The local environment cannot be sufficient because we must also account for its organization. Our principle of explanation must account not merely for our local history but for all local histories and their parallelism. It must account not merely for the past and the present but also for the pregnancy of the present with the future, though we must bear in mind that past and future are relative terms and that what is past in our local history may, in its general features, be future in another history and vice versa.

We say that all the local histories throughout the cosmos move within a field of Cosmic Control, call it by the name of Cosmic Genius or by the name of God—more personal and sacred in its associations. This Cosmic Control must be adequate to account for the organization of nature hitherto, but is not exhausted by the past, nor by what can be realized in any one cosmic process. It works in a pluralistic world in space and time, and guides the figurations and passage-work within any one history and the interlacing of local histories into a world. In short, it is our world, not a mythological world, which we must set ourselves to understand, so far as possible, within the limitations of our mind and the pathetic brevity of our lives.

Our conception of evolution is that of the emergence of a scale of grades of organization under cosmic control. Matter has no privileged position. Matter and the laws of matter emerge in the evolutionary process. Matter is not conceived as the mere downward trend of life—the débris of organization, as Bergson conceives it. But matter is part of the evolutionary ascent from the comparatively formless situation in the primitive nebulae to higher and higher degrees of organization. Matter itself as we find it is already spiritualized through organization. It has remarkable beauty of structure. It runs its cycle of existence, ascending in organization into the patterns of

atoms, molecules, crystals, and in the passing of the cosmic seasons devolving again into the simpler states, whence it came. The time span of the atoms is for the most part of vast length, but we can see the process of devolution, before our very eyes, in the radioactive elements. The evolution and devolution of matter run their course in obedience to cosmic control. There is no reason for despising matter, but rather admiring it, as indeed every physicist and chemist does. Matter is not the inert lumpy thing of the old physics, but active, sensitive, plastic, with marvelous architecture.

If matter has no privileged position in the evolutionary scale, neither has life a privileged position. Life emerges, in the cosmic seasons and under cosmic control, from the inorganic, or rather it is a continuation of the organizing genius which we find manifested in the inorganic. The building stuff is the same but life comes to have new properties by virtue of creative synthesis, until it rises to the level of intelligent behavior. Living things run their cycles in the cosmic process. They have their descent as well as ascent. For the most part their span is brief, though the simplest units of life, as of matter, seem to have a very long existence. Death, it has been said, is the price nature exacts for complexity. But even the simplest organisms have their season in the cosmic climate. The evolutionary ascent takes place through the stream of life from generation to generation. But the stream of life is not something apart from its environment. It includes its field. The stream of life of which we are a part runs its cycle within the earth cycle, devolution following evolution. The earth cycle itself runs its course within the solar cycle of which the earth and the other planets are a part. And the solar cycle runs its course within still more comprehensive cycles within which galaxies of stars rise from nebulae. But all the cycles run their course within the field of cosmic control. Emergence at any stage involves more than the antecedents in the same series. It involves also the field in which the particular history runs its course. This field furnishes the direction of the temporal process as the gravitational field furnishes the guidance of the stars in space.

The ultimate impetus to advance must come from the cosmic whole. The evolution of nature—from the atom to human art—is a process of trial and error response on the part of the individual, at a particular stage of its evolution, to express the structure of the whole in terms of its own individuality and limitations. The point of view of emergence is a local point of view. It fails to grasp the significance of the guiding field of the whole. To say that certain qualities emerge when a certain milieu of energy occurs in nature is true enough. But this does not account for the emergence. This involves the cosmic milieu, with its delicate balance and interplay of histories. Why should there be organization at all? And why should it be forward-looking in a local history so as to establish the conditions for life? And why should it radiate in various directions with mutual reference, as in plant and animal life? We have come to recognize that the environment is a necessary factor in bringing about new organizations of forms and organs in the evolution of life, whether we consider individual or racial development. Even if we grant that combinations may take place, amongst the factors of the germ-plasm, independently of the environment, and that these combinations may give rise to variations in the offspring, yet such variations in isolation could not account for cumulative adjustment.

The environment has the first and last word. It furnishes the stimulus to adjustment and it acts selectively on the result. All characters are in the last analysis acquired characters. The impetus is direct and obvious in the unicellular organisms, but it becomes veiled in the complexity of the internal re-organization in the multicellular organisms. For the adaptation is never the result of just the external stimulus. It involves also the system of energies of the responding organism. And it may require a vast number of generations before the particular mechanism of adjustment is perfected, as for example in the evolution of the eye. What we wish to emphasize is that new adaptive organization could not take place except for the environmental field, including in the last analysis the whole cosmic environment. This is true in the organization of atoms and must be

true all the way up. There is more to the synthesis of water than the proportion of two parts of Hydrogen to one of Oxygen. There is the stimulus which overcomes their inertia, and there is the cosmic field in which the synthesis takes place and which by virtue of its structure dictates the formula. The structure of water is not implied in either Hydrogen gas or Oxygen gas or in the addition of their characteristics nor is it implied in the degrees of intensity of the stimulus—heat or electricity. This furnishes merely the permissive condition. It cannot supply the structure.

Throughout the cosmic process the organization is guided by the cosmic field within which the individual exists, though the particular result is conditioned by the organization and history of the individual. There must be preparedness on the part of the individual for a higher organization; and this preparedness includes plasticity or permeability. But the permissible pattern, towards which the individual must move in order to develop and prosper, is figured by the cosmic environment, from the atom to man. The realization of this pattern in the unique milieu of the individual is selective and forward looking. The whole process is fundamentally teleological, not to an idea in the individual but to the creative genius of the cosmic field. The cosmic field prescribes the type or quality, though not the mechanism of the advance. This is the result of a trial and error process on the part of the individual. But the individual himself, from the first elementary stage of organization, is the product of a history of adjustment within the cosmic field.

The whole process of evolution is a process of spiritualization. Those who look for Spirit and God in the first stuff of things are looking in the wrong direction. The atom shows more of divine genius than the electron, the molecule than the atom, life than inorganic elements and so on up the scale of organization. The reason that we find beauty and intelligence in nature in even its simplest stages is that even here—in the atom, in the inorganic compounds—we are not dealing with inert, passive matter (which is a fiction of philosophers) but with spiritualized matter. In the understanding and appreciation of the lowliest

matter, "spirit with Spirit may meet," even though the range is limited. We must postulate pure spirit as the energizing medium throughout nature and not only in the life of the highest beings. The whole hierarchy of beings from the electron to man, and whatever may be above man, lives and moves in the medium of Spirit. Just as our whole body has a unique quality because it is dominated by the field of mind, so nature throughout has a unique quality, because it is dominated by divinity; and in our moments of artistic innocence we intuit and appreciate nature as thus spiritualized. That is the reason no man can be a great scientist unless he is a poet.

The advance cannot be ascribed to the forming of ideas or intentions on the part of the individuals in the series. For ideas and intentions cannot be said to exist except at the highest levels. We cannot attribute intentions to the electrons or atoms or molecules or even to life until we reach human development. And even at the highest level of creative thought, the restlessness and creative synthesis which lead to new insight come largely from the unconscious. Ideas are but instruments to fix the attention, though they have great advantage over slow-groping habit. Reflection is an afterthought to bring creative synthesis into the clear light of day and may be useful in calling our attention to error. But reflection cannot create nor does it understand the laws of creativeness. The impetus to creativeness, whether at lower or higher levels, comes from our rapport with the genius of the whole.

In this creativeness the individual part counts. There is always the inertia of the individual—its tendency to persist in its own motion—at any stage of the process. At the lowest stages, that of electrons and protons, the adjustment of the parts to the superimposed pattern of the cosmic field seems automatic and precise. This is true, at any rate, when we view them collectively. It is a fundamental law, including all reality, that the degrees of freedom increase with the degrees of complexity. It is with the highest stage of complexity—that of the self—that we associate freedom in a purposeful sense, i.e. a choice of organizations. At the lowest stage the organization is pre-

cisely predetermined, though not the individual action. At every stage we must reckon with what William James called a "dumb willingness." Progress belongs to the venturesome. The creative future cannot be foreseen by the individual history. Our faith in the prospective value and reality of our individual life, our faith in the value and existence of our fellowmen, our faith in the meaning and existence of the external world, our faith in the meaning and wholeness of reality must be creatively realized by a venture into the unknown.

While the degrees of selectiveness and freedom are, so far as we can see, vastly greater in intelligent human beings than in the individuals below them, we have no right to deny some degree of "preference" in the lower stages. We must recognize degrees of plasticity, of selective adaptation, all the way from the electron to man. The levels at which an electron can appear are determined by the structure of the field, but it is not predetermined that an individual electron must appear at a certain level, though where the intensity is great, i.e. the numbers large, it is highly probable that we shall encounter an electron. The apparent determinism is statistical, just as in dealing with large numbers of human beings we are able to predict with considerable accuracy the percentage of marriages or suicides in a given population in a certain month of the year, if the conditions are otherwise uniform, though we cannot predict with any certainty in individual instances. We have no right to erect statistical averages into norms for individuals, though we have been prone to do so.

It is a fact that only a small proportion of individuals at any level obey the impulse from the whole to the part to advance to a new level when the local conditions are ripe. Most individuals remain in their *status quo*. They do not venture to change. Here we have *the* great refusal—the refusal to advance. Only a portion of electricity is organized as atomic matter. The universe is full of loose electrons, either in a static oscillating condition, or in the form of electric currents. Electric currents produce a magnetic field and so are a level above static electricity. For electrons to fall into atomic patterns a new control

must be superimposed. The atoms, again, differ in their valencies, i.e. in their capacity to combine with other atoms to form molecules which are more complex structures. Some atoms will not combine at all under ordinary conditions, though the extraordinary intensities, now available, are overcoming their inertia. Only a few elements combine to make life compounds.

If we follow the advance of life, we find that the variations which lead to an advance toward new species and levels are rare. The great mass of the amoebas, for example, have probably remained comparatively constant during vast ages of time. Only a small part of unicellular life ventured on the advance to multicellular; and so on through the ascent of plant and animal life. And we know in our own experience on the human level that the insight which leads to advance, to adjustment toward the future, comes to a few rare individuals, while the great mass prefer the *status quo* and make martyrs of those who preach the kingdom of heaven—the salvation in a higher type of organization. There is a difference somehow in quality, which resolves itself in the last analysis into a difference in plasticity to new patterns of relations and which shows itself in a restlessness, a search for an equilibrium within a higher mould, as an atom is restless until it has found a new equilibrium within the molecule. This difference in responsiveness, in plasticity, in readiness we may call a difference in "willingness" if we dissociate this term from purpose and self-consciousness, which we must do even in the most fundamental human assents and dissents. Throughout nature it holds that many are called but few are chosen, because few are willing.

The part at any rate is not a mere passive instrument of the whole. There is no merely passive matter. Plato granted to matter the property of resistance (which the demiurge overcomes by persuasion as far as he can) and made it responsible for the failure of form in obvious instances. But if we credit matter with the failure of form, why not give it a little credit for lending itself to form? Unless we recognize the fundamental importance of the "willingness" of the part to lend itself to structure, the whole scheme becomes mechanical.

This factor of individual "willingness" saves evolution in the local cycles from being mere repetition. In the most thorough-going system of cosmic preformism—that of Stoicism—, each cosmic cycle is a detailed repetition of the preceding. The individual merely acts his prescribed part. In our view of cosmic interaction of histories within a whole, the individual rôle is not thus predetermined. There is indeed a structure of the whole and successful advance must follow the lines of this structure. But the individual is not obliged to advance. He may choose to remain in the *status quo*. He may choose to relapse to a lower level. We have abundant examples of such preferences on the human level of behavior. At best only a few are venturesome and courageous enough to experiment in order to discover a higher level of life.

If the individual chooses to advance, the means of advancing are not determined. The realization of structure in the concrete expresses individual genius. It also expresses racial genius or tradition, though this in turn is the cumulation of individual genius in its effort to use the local environment. There is also the contact of traditions with its fructifying or deteriorating influence. But whatever may be the tradition, there is always discernible in all genuine creativeness the individual factor which makes one man's expression different from any other. This is patent in artistic creation. Shakespeare and Ben Jonson can be distinguished in their work, though they are both Elizabethans. It is equally true in moral conduct. Two men may embody the same moral code, but they create different lives with unique values.

If we substitute world histories for human histories, we can see how two histories, which are apparently analogous in all material respects might still reach an entirely different outcome in civilization. What might our human history have been if more individuals had been venturesome and sincere to experiment to arrive at higher levels of life? And what would it have been without those daring pioneers who have ventured into the unknown to enlarge the boundaries of human knowledge and appreciation? The great tragedies of history are after all indi-

vidual blunders or an accumulation of them. And the great advances are individual creative ventures and an accumulation of them. Advance has a logic or continuity which blunders cannot have. It is constructive and consistent, though the consistency owes its significance to individual effort. The general form of art or morality or thought may, therefore, be universal, but how various is the realization and value! One history does not in the concrete just repeat another. It is, at any rate, repetition with variation. Whether the variations form an ascending series towards deity or a descending series towards the devil depends upon the willingness and insight of the individual. The structure of value is eternal, but its individual realization calls for venture and risk. The outcome so far as the participants are concerned is not guaranteed. It may be comedy or tragedy. They must discover the viable way through creative trial and suffering.*

* For a fuller statement of the author's interpretation see the companion volume, *God*.

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