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GODS AND MEN

GODS AND MEN

A Testimony
of Science and Religion

By
SIR RICHARD GREGORY
BT., F.R.S.

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PREFACE

SCIENCE and religion meet on common ground in the study of invisible forces and the effects of these external influences upon human thought and conduct. All systems of philosophy—secular or sacred—construct mental concepts of relationships between objective realities and ideas concerning their nature.

At all stages of civilization celestial objects and phenomena have been used as factors of material service as well as for worship of divine attributes in them. In the design of the present volume these two attitudes of mind are traced throughout the ages, with due regard to advances of natural knowledge and the corresponding expansion of intellectual outlook.

The early chapters are thus devoted to considerations of the Earth's place in the Universe and the growth of ideas about the nature and movements of the Sun and other members of the Solar System in relation to the starry spaces. These objects and events have been made the foundations of most religious faiths, whether regarded as divine personalities in themselves or as symbols of their Creator. They are used everywhere to construct secular calendars and determine the dates of sacred festivals.

These and other religious observances are intuitive responses to perceptive influences, whatever forms they take. They are expressions of the human spirit and are represented in all religions, from primitive cults to the most philosophic. There are, and have been, many systems of faith and worship, each with its own history, doctrines and rituals, and none having exclusive communion with what is conceived to be divine.

Neither fervent faith nor the number of believers attached to it can be used as a measure of its truth, though both have influenced the progressive development of human societies. The standards of such advances are mental as well as material, social as well as sacred, rational as well as emotional. Civilization cannot be defined in terms of religion or without them, but by the wisdom with which knowledge is used to promote general "well-being" and "well-doing". This makes works a measure of the significance of faiths,

reason the breaker of superstitious images, and world religion the pursuit and comprehension of knowledge in the spirit of exalted humanism.

Certain chapters of the present volume incorporate matter from my *Religion in Science and Civilization* published in 1940; but the edition was soon brought to an untimely end by an enemy air-raid. There are, however, clear differences between the two books in both pattern and substance, largely because of the new aspects and outlook of mankind and civilization created by the Second World War.

R. A. Gregory.

I

HEAVEN AND EARTH

RELIGION and science are the two chief factors which have influenced human development throughout all stages of civilization: religion as the reaction to an inner impulse as to what is conceived to be sacred and arouses awe or reverence, and science as the accumulation of knowledge of the properties of natural objects—animate and inanimate—in relation to man's needs, and his understanding of them through the use of his intelligence. One represents the emotional side of man's nature, as expressed in religious ritual, art and literature; the other—also the product of an inner urge—is the construction of a mental picture which gives acceptable form to what is known, at any stage of inquiry, about the nature and origin of all things, visible and invisible. It is in the study of the heavens from these two points of view of worship and inquiry that religion and astronomy meet in celestial fields.

From the very dawn of human consciousness the starry sky at night and the majesty of the Sun in the day have aroused wonder and been associated with super-human influences. The two-fold division of Heaven and the Earth into celestial and terrestrial places is common in the traditional belief of most peoples and is expressed in the opening of Genesis with the words "In the beginning God created the heaven and the earth". It represents the expanse of space in which the Sun, Moon and Stars are seen as permanent, orderly and mysterious and the Earth as transitory, changeable and material in its objects and phenomena. To theology —"the science of things divine"—the heavenly bodies have a spiritual meaning, while astronomy is devoted to the study of their material nature and the natural forces which determine it and their movements.

Heaven as a place or state of eternal bliss to which the spirits of the just ascend is a primitive idea based upon the belief that the Earth was flat with azure domes above it carrying the various celestial objects. Other places believed by different peoples to be the sites of departed spirits were not in the sky but below the Earth or in the extreme west with the ever-shining Sun. In general, however, the sky has been regarded as the seat of deities, each with its own spiritual function and often with angels and saints sharing their holiness. These imaginary states of existence have always inspired exalted poetic and figurative fancies, but their standards

of value are those of aesthetic beauty and emotional expression rather than that of observable truth.

When man emerged from the tree-tops to stand upright with his feet upon the Earth he became possessed of new powers of outward and inner vision. In common with other living things, his nature was derived from his ancestry, and for his nurture he had to make use of what existed around him, whether provided in infancy by his parents or by his own exertions at other stages of life. He was purely a creature of circumstances long before he gave thought to the natural processes and events which constitute them or he conceived supernatural powers to create and control them.

Every form of life on the Earth represents a structure in which the constituent parts are continually being renovated under the influence of external and internal forces. These forces become manifest only by their effects, and all of them may be operative agents of a single unifying principle of action. All things, animate and inanimate, are affected by powers outside themselves, and each responds in its own way to the force of its circumstances.

Living things are distinguished from non-living by being able to make use of external influences to reproduce themselves. A seed is thus able to germinate and produce a new plant when certain conditions of warmth, moisture and air are available. If the seed is in the soil, the first stage in its development is the growth downward of a part of the embryo to form the root. At the same time another part grows upward into the air to form the stem or shoot of the plant. One part therefore proceeds downward under the influence of the Earth's gravity while another moves upward towards the light. Each is endowed with the power to respond to particular forces, and each is negative to the influence which affects the other.

The influences of gravitation and of light existed for untold ages before there were plants or any other forms of life on the Earth. Also, long before man came into the world, countless other animals depended upon plants for their daily supply of food. He accepted his inheritance without the need for thought as to how it had been acquired or into the powers and processes by which its richness was maintained. As he became more human he realized that the moisture of rain and warmth from the Sun were directly associated with the growth of vegetation and the range of his food supply.

His world was where he lived and had his being; and like other creatures he had to adapt himself to the natural conditions around him in order to survive. It was a world of land and water and many other things which could be seen as well as touched and tasted, and also of invisible air and the force of winds in it. Above all was the sky with the Sun ruling the day, while other lights apparently

remote from the Earth and yet closely related to it by their influence illumined the night.

A common belief among primitive peoples and in ancient times was that the sky and the Earth were originally joined together and were afterwards separated. In course of time the firmament of heaven was conceived as including the atmospheric region of the Earth as well as the canopy upon which the Sun, Moon, planets and stars had their places. The daily unfolding of this celestial panorama, with its alternations of daylight and darkness, brought about rhythmic responses in all forms of life and, with the expansion of human consciousness, became associated with qualities of good and evil—of gladness and fear.

In their reactions to the influence of light the whole world of living things may be said to acknowledge that "All good gifts around us are sent from heaven above". Ever since song-birds appeared upon the Earth they have been rendering homage to the kingdom of light by their paean of thanksgiving at the passing of darkness and the coming of dawn; and they are doing so somewhere at this very moment. This form of salutation becomes worship when the physical force of light is endowed by human feeling with divinity, and terrestrial events are given celestial interpretations.

All such interpretations represent endeavours to understand and explain natural properties and events in super-natural terms. They must all begin, therefore, with man as a particular form of life adapted to particular conditions in a particular part of the universe. It is improbable that anywhere in space there is another world of land and water and air exactly like the Earth and with a Sun of the same size and temperature at the same distance; and even if there were it is unlikely that life and light would be associated with it in the same way. It is as true today as ever it was that man has not only specific physical and mental characters unlikely to exist anywhere outside the world upon which he has grown, but also a unique outlook on the universe.

From this terrestrial watch-tower men have always been impressed by the majesty of celestial scenes and have pondered over them. What they have also always tried to discover are the relationships between the material world on which they stand and the superhuman powers in the heavens above them. This canopy was thought to be just as solid and real as the Earth itself, and to the human mind each was part of the other. Imagination as well as observation was used to conceive how the heavens and the Earth came into existence, what constituted their particular parts, and why the Sun and other celestial objects move as they appear to do.

When thoughtful men of ancient times gave attention to these

subjects they aimed at the construction of a rational system of the universe which would satisfy their experience as well as their perceptions. They were philosophers constructing mental models in which observed facts and principles were combined with human feelings to represent natural truth. Much has been learnt about the ways of things in the sky since those early days of man's seeking to comprehend them; and the structures conceived to account for them look very crude in the light of such endeavour. As knowledge increases and the human mind expands, old interpretations of the nature and design of the universe have to give place to new. No scientific philosopher would claim to have arrived at absolute truth but only to be using human sense impressions and mental insight to discern it.

The Sun, Moon and stars are the same today as they were when the eyes of man first regarded them; and many facts have been established as to their nature and movements. For the primary needs of life it does not matter whether the Earth is thought to be flat with a solid dome resting upon it, or a globe poised in space and by its rotation enabling one-half of it always to be turned towards the Sun. Precisely the same succession of daylight and darkness would occur if the Earth did not rotate and the Sun revolved around it in twenty-four hours.

There are, however, now direct means of demonstrable proof that the Earth is a globe and that it rotates once on its axis every day. Also, that the Sun is a much larger body at an immense distance from the Earth. These are natural truths, but why things are what they seem to be, with properties which can be observed and studied through human faculties, raises questions which still belong to the realm of speculative philosophy.

When early philosophers constructed their frameworks of the heavens and the Earth they combined the science of astronomy with that of theology. In the mythology of ancient Egypt, the Earth-god, Seb, was represented as lying on the ground and arched over him was his wife, Nut. Shu, a child of the Sky-goddess, divided the heavens from the Earth and personified the firmament of clouds and stars. The Sun-god, Ra, was supposed to be carried across the firmament in a boat from the eastern to the western horizon, from which under-world—abode of the dead—it would rise reborn on the morrow.

The forms assigned to these divine beings may be regarded as symbolical and imaginary. As such they belong to the mystic side of natural theology rather than to natural science, and are comparable with the figures of deities and saints of religious art and sculpture thousands of years later. At every stage they represent



Hieroglyphic representation of the Earth and sky, from an ancient Egyptian papyrus. The recumbent figure covered with leaves represents the Earth. The heavens are personified by the star-bespangled body of a sky-goddess, Nut. Separating the two figures is Shu, the human-headed god of the air, holding in each hand, and on his arms, the symbol of life. The rising and setting suns are shown in boats which move across the heavens over the body of the sky-goddess.

emotional reactions to natural objects and scenes and not the positive knowledge of observable attributes which is the concern of natural science.

The Sun and other bodies in the heavens, and phenomena associated with them, were observed as rudimentary physical facts before the human mind introduced gods and goddesses into their astronomical systems. Within the limits of knowledge available, this line of reasoning was just as logical as that used today in relating causes to effects. The endeavour is still to interpret factual knowledge and to express it in simple and fundamental concepts or theories. The first association of astronomy with religion was that of assigning the powers of unseen influences to personal deities.

Astronomy is still the science of the heavenly bodies, but these are studied as physical objects and not as living beings. What the force or forces are which give particular properties to things is still beyond explanation, except in terms of their actions. Study of their effects is the purpose of observational and experimental science, but imagination, insight and intuition are as necessary as ever to under-

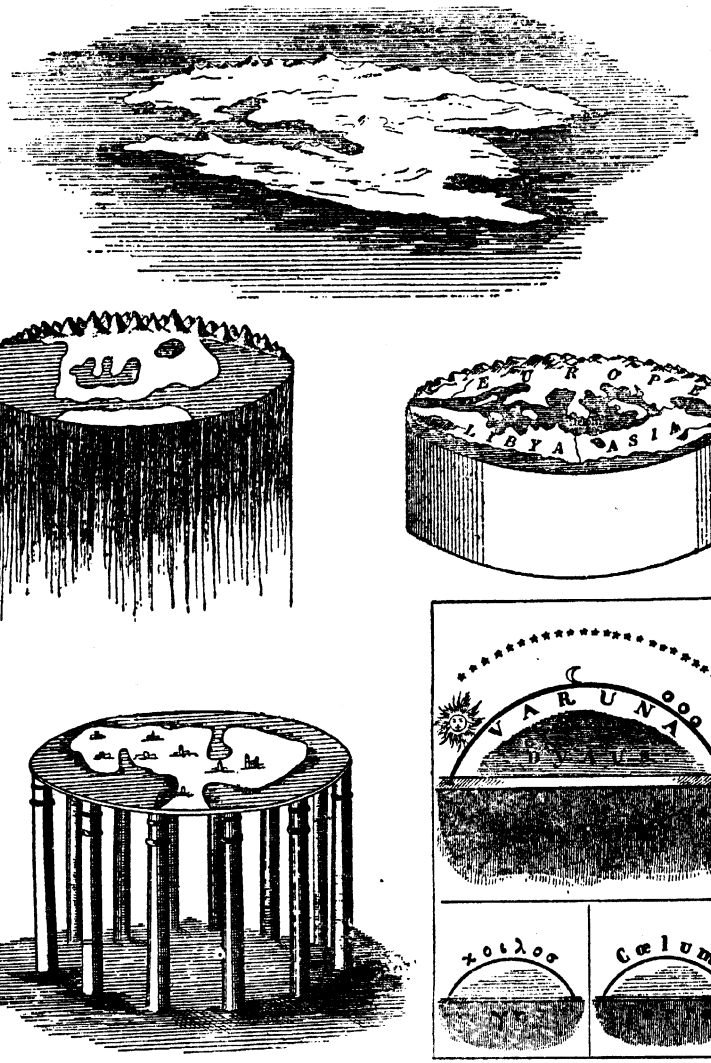
stand the evidence and arrive at acceptable conclusions upon it.

With the recognition of the heavens as a great power station having superhuman beings in charge of their influence, came the association of light with life and goodness, and darkness with death and evil. Whether the higher abstract qualities attributed to celestial beings are reflections of what are observed and admired in human communities, or reactions to divine influence, is a question in which both instinct and intelligence are involved. What is known is that all peoples have given names to prominent celestial objects and constellations, but whether such appearances suggested these descriptions, or their terrestrial effects were projected by imagination to the sky, requires more evidence from the history of mythical ideas before the point can be decided.

In ancient Vedic mythology the early deities represented dominating natural forces and included wind and thunderstorms as well as the Sun, Moon and stars. The deity of the blue and star-spangled sky was called Varuna. Beneath this luminous vault of heaven—the region of the clouds—was the throne of Dyaus, who was coupled with Prithivi—the wide expanse of the Earth. From this pair—Father Heaven and Mother Earth—men as well as gods were supposed to have descended. These came to be thought of as children of Varuna, the greatest of the deities of the *Rig Veda* and the upholder of the physical sky as well as of the moral order. Similarly, in Greek mythology Varuna is identified as Uranus, whose children were Heaven and Earth, one a concave vault and the other the surface of the world. Dyaus became Zeus to the Greeks and Jupiter to the Romans, but each was conceived as the supreme ruler of both Earth and Heaven, though the primitive ideas of the cosmic structure remained the same.

Religion became attached to astronomy when ethical and moral qualities were attributed to the Sun, Moon and other celestial objects, as well as to storms and rain and similar phenomena of the invisible air. It was just as reasonable in early times to give the name Dyaus to the region of the clouds as to describe it as the Earth's atmosphere. When also it was realized that unseen forces were the causes of impressive effects and appearances it was just as natural to assign names of deities to them as to call them light, gravitation or electricity, by which they are known today. The study of natural objects and phenomena in the heavens and on the Earth has shown, however, that things are not what they seem to be at first sight, and that their physical behaviour can be explained as natural consequences of actions and reactions between force and substance.

Here it should be said at once that this does not imply that



Primitive ideas of the Earth and its foundations. The solid Earth has been conceived as floating on water, as shown in the top picture. When travels had shown that the horizon was always circular, the flat Earth was represented as a disc beneath which were roots or pillars reaching downwards without any imagined support for them. Anaximander, an early Greek philosopher, gave the Earth the form of a short cylinder said to be supported on air, with the stars on a crystal sphere above it. This idea of the heavens above and the flat Earth beneath is first found in hymns of the *Rig Veda*, from which it passed to the Greeks and Romans.

physical force can be defined any more precisely than when it was given divine names in patterns revealed to the mind. Astronomy is a branch of the science of physics, which deals with the properties and actions of the different observable forms of energy and matter, and is thus primarily concerned with what is observable and not with the supernatural or super-rational. It includes the mathematics of celestial machinery and the concepts of space and time, and is an endeavour to correlate what is known of the different parts and their movements and can be comprehended by the human mind. The ultimate meaning of all that can be explored by observation or imagination belongs to the realms of metaphysics and theology, and not to astronomical science.

Observational science began when the appearances of things on the Earth and in the heavens were noted; and scientific thought when they were related one to another. That the Sun and the stars existed, and were related to the Earth by the daily alternations of aspects of the sky, were truths of common experience, whatever their explanation. The regular succession of these events gave the human mind a measure of time as affecting things upon the Earth long before the idea became an abstract concept. To all peoples the world on which they lived appeared to be a flat surface diversified by hills and rivers and with many forms of plant and animal life sharing the land with them.

Each race thought of its country as the centre of the world and the whole Earth to be at the centre of space. As the horizons were extended by travels on sea and land, the theory of a flat earth had to be abandoned because it was contrary to observed facts. Then came the idea that the Earth was a cylinder or a cube, only one end of which was inhabited; afterwards there was the conclusion that it was a globe. All these views as to the shape of the Earth represent stages of growth of factual knowledge and scientific thought. There may still be people in Britain, as there are in less advanced countries, who believe that the Earth is a flat disc with the north pole at the centre and inaccessible mountains around the edge; but as aeroplanes have now been flown over the south pole as well as the north they must depend for their convictions upon faith and feeling and not upon demonstrable evidence.

In early frameworks of the heavens and the Earth each of these parts of the universe was thought to need foundations of one kind or another. The canopy of heaven was supported by the Earth, and the Earth was held up by pillars, or set in roots reaching downward without end, or floated upon water or humid air. It was a long step to the position of the Earth as a world poised in space without means of suspension or support, and a longer one to believe that

it was neither fixed nor the centre of the visible universe. Each and all of these views were attempts to describe measurements—first of areas on the Earth and then of a third dimension above it.

The ancient Egyptians used principles of geometry in the surveying of land and construction of pyramids before the Greeks organized this and other branches of mathematics into a science. They knew that in a right-angled triangle the lengths of the sides are in the ratio of 3 : 4 : 5, and also how to calculate the area of a circle, knowing that the circumference of a circle is greater in length than the diameter by a little more than three times. They were the first practical surveyors, and the simple arithmetical formulæ used by them enabled sizes of fields to be defined and great buildings to be erected.

By the extension of these methods it became possible to determine distances without using an actual measuring rod or tape, and also to calculate the size of the Earth, assuming it to be a globe. In the second century B.C. the Greek astronomer and geographer Eratosthenes observed that at the summer solstice the Sun was directly overhead at noon at Syene (Assuan) and therefore cast no shadow. At the same instant the shadow of a pillar or gnomon at Alexandria showed the direction of the Sun's rays at this place to be one-fiftieth of four right-angles; that is, of 360°, or in angular measurements 7° 12′ away from the vertical.

The distance between the two places was known to be five thousand stadia, and a stadium is taken by some authorities as a measure of length equivalent to 517 feet. As they were both on nearly the same meridian, a circle through these two points would pass completely around the Earth and its length would be 50 times 5000 stadia. The circumference of the Earth could thus be calculated, and from the result a diameter was deduced which is only about fifty miles less than the 7920 miles now accepted as the distance from pole to pole through the centre of the earth.

The same principles are used to determine the size of the Earth to-day, but with far more precise means of measuring distances and angles. First, the distance between two places several miles apart is measured and its length forms the base-line. From the two points sightings are made to other distant points, and each of these gives the third point of a triangle.

As large a tract of country as possible is covered by this system of triangulation; and when this geodetic part of the work is completed the survey enables the north and south distance between two points to be found, that is, the distance between two points on the same meridian, or the length of an arc of the Earth's circumference.

By astronomical measurements the difference of latitude between two stations hundreds of miles apart is determined in degrees of a circle. As there are 360 degrees in a circle, and the distance between a certain number of degrees on the Earth's surface can be expressed in miles or kilometres, the length of the complete circle can be easily calculated.

These observations and measurements combine to show that the Earth is sphere-like in shape but not a perfect globe, being flattened at the northern part and bulged at the equator, and departing in other ways from a truly geometrical form. There are different theories as to the exact figure of the Earth and its past and present history, but that the world of man is a ball of land and water surrounded by an atmosphere of air is a scientific fact which cannot be reasonably disputed. Also it has long been established that the Earth is not rooted or immovable in space, as for ages it was supposed to be, but rotates or spins like a top once in twenty-four hours. This causes the successive appearances of the Sun by day and the stars by night.

The particular rate of spin of the Earth on its axis decides the length of the day everywhere, though the number of hours of daylight varies from the equator to the poles and during the year. For practical purposes the day is divided into hours, minutes and seconds, or fractions of the Earth's rate of rotation. It is known that this day-period is not absolutely constant, but as the lengthening is estimated to amount only to a single second in 120,000 years, the difference in length from one century to another has been negligible in the six thousand years of civilization.

The standards of time used on the Earth are derived from observation and experience on a rotating globe occupying a certain part of space, and they belong to life on this planet alone. As an abstract concept time is absolute, and measurements of it anywhere in the universe express only points of view of successive events and effects. It is independent of all local standards and of all movements of the Earth or in the heavens by which it is measured. When astronomers say that the Earth is about two thousand million years old, and geologists that man became a sentient being upon it about half a million years ago, these numbers have no meaning in absolute time and are only numbers expressed in terms of human life and comprehension. Neither time nor space can be thought of as having a beginning or an end, but only in relation to objects visible or invisible in them.

We know that we live on one of many material bodies and can observe their distribution and distances, but infinite time and space are beyond human understanding, which cannot comprehend even

the vast numbers recorded by terrestrial measuring-lines. To the naked eye only about six thousand stars can be seen in the universe, but it is now known that one hundred thousand million are in that part of the heavens bounded by the Milky Way, and that beyond this there are several millions of similar galaxies, also with thousands of millions of stars in them.

Soundings of space have revealed similar incomprehensible dimensions. Even reckoned in millions of miles the numbers convey no meaning, and to bring them within the grasp of the human mind they are expressed by astronomers in terms of the velocity of light, which travels at the rate of 186,000 miles a second. A ray of light from the Sun takes eight minutes to reach the Earth, a distance of 93 million miles. From the nearest star the light messenger needs more than four years of travel through space before it touches the Earth, and there are stars so far away that the light received from them to-day started on its journey five hundred million years ago.

The expansion of space brought about by scientific conclusions of this kind puts the gods, which were believed to occupy prominent objects in it, at distances from the Earth vastly greater than they were conceived to be in earlier times. The stars seem to be the debris of a convulsed cloud of primordial celestial mist, and the star which we call the Sun gave birth to the Earth and other members of the solar system. The common belief of primitive peoples, therefore, that the sky and Earth were originally joined together, is true in an astronomical sense but not in living form. Like all other bodies in the universe this world of ours is a speck of matter in space, and it belongs to the heavens as much as any of them.

The idea of Heaven as a curved arch or starry ceiling, though still widely cherished as an element of religious faiths, has been abandoned as a locality and become the symbol of a spiritual condition. It is in this figurative or pictorial sense that learned Christian scholars have long understood the words "God in Heaven". The references in the New Testament to Christ, at His last appearance to His disciples, being "carried up into heaven"—where "many mansions" would be prepared for them—are not to be interpreted literally but as confirmation of the continued presence of His spirit, and the exaltation to be derived from it. Heaven is thus wherever and whenever this sublime attribute is perfected, and the promise is that it is attainable on the Earth in its part of the universe as in any other physical object in the celestial spaces.

That man has mental and moral qualities of an immaterial kind, to which the name spirit is given, is as scientific a fact as measurements of his heart or head. The exercise of these attributes influences himself and others during life and afterwards, but it belongs to the

Earth and not to any other place in the universe. It is not for natural science to say whether or not individual spirits survive as personalities after death; but in time and space the Earth is as much in the heavens as any other of the many million forms of matter revealed by astronomical inquiry. Whatever, therefore, may be the meaning or the purpose of man's existence, the best teaching of any religion is that which promotes works to make the Earth itself truly a celestial dwelling-place, and thus to glorify the powers within him, with the knowledge that the past, present and future have no meaning in the absolute concept of time, and that eternal life is now and always.

When time is conceived as having no beginning or end, measurements of it become durations of intervals between successive events, with terrestrial units as standards. The history of life on the Earth is thus estimated to have begun twelve hundred million years ago. In a documentary film of twelve reels, each lasting an hour, and each representing a hundred million years, primitive man would not appear in the panorama until the last minute. Our direct ancestors would make their entry less than a second before the end of the picture. In this short span of ten thousand years the spirit of, or in, man has been displayed in many ways in faiths and works, but always in the infinitude of time and space, whatever finite ideas have been held as to Heaven and Earth and the meaning of human life throughout the ages.

II

CELESTIAL MOVEMENTS AND MEANINGS

The reactions of human consciousness to the scenery of the heavens or the Earth may be religious, aesthetic or scientific, and each has its own standards of value. No single one of this trinity of response is competent, therefore, to interpret the outlook of the others. To many minds, wonder at impressive natural scenes leads to worship. In others, a sense of beauty is provoked and expressed in lines of literature or art, and in the third group the spirit of inquiry is induced, to which the term "natural science" is applied. The object of this branch of knowledge is to discover what things are and how they behave, and thus to learn as much as can be comprehended of natural properties and principles, without

bringing in supernatural agencies to explain them. The pursuit of truth of this kind belongs to religion as much as to science, because at every stage it reveals greater wonders.

A certain amount of astronomical knowledge, as well as conceptions of the nature and origin of the universe, was derived by the ancient Hebrews from the Babylonians and was probably introduced into Palestine by Abraham. During their exile (586–539 B.C.) they acquired a tendency to idolatry in the form of Sun and star worship. In the sacred books of the Hebrews there are, however, few allusions to what may be termed the rational understanding of the universe, and few precise observations, such as have been preserved in the records of other ancient peoples. Astronomical or other natural objects or phenomena described are used for poetic imagery or spiritual purposes, and not for scientific analysis.

The Hebrews saw all things as testimonies to the wisdom and power of the Almighty and His goodness to man; as subjects of wonder and spiritual exaltation rather than as matters of intellectual inquiry. This spirit is represented in the words:

> "When I consider thy heavens, the work of thy fingers,
> The moon and the stars, which thou hast ordained;
> What is man, that thou art mindful of him?
> And the son of man that thou visitest him?"
>
> Psalms viii, 3, 4.

While, therefore, there are many passages in Holy Scripture which show sympathetic observation of the phenomena of Nature, there is little in them that can be said to have much scientific significance. Notwithstanding this, it cannot be assumed that the Hebrews were less observant of natural things and effects than the peoples of neighbouring regions, though their reactions to them were purely spiritual. In the Book of Wisdom (vii, 16-20) the standard of natural knowledge set before the mind of man is high. The book was not, however, composed by King Solomon, as popularly believed, but much later (probably about 200 B.C.); and the impact of Greek thought is clearly shown in it. The number of subjects to which attention is directed in it would be sufficient for a syllabus of general science today. They are:

> "An unerring knowledge of the things that are;
> To know the constitution of the world and the operation of the elements;
> The beginning and end and middle of times,
> The alteration of the solstices, and the changes of seasons,
> The circuits of years and the positions of stars,

The nature of living creatures and the raging of wild beasts,
The violence of winds and the thoughts of men,
The diversities of plants and the virtues of roots."

Another passage from the Apocrypha (Ecclesiasticus, xliii, 1-12) shows that the Hebrews looked to the sky for times and seasons as well as for worship, but to them this knowledge was not regarded as of such a sacred character as that of their spiritual communion with God.

"The pride of the height, the clear firmament, the beauty of heaven, with his glorious shew;

The sun when it appeareth, declaring at his rising a marvellous instrument, the work of the most High:

At noon it parcheth the country, and who can abide the burning heat thereof?

A man blowing a furnace is in works of heat, but the sun burneth the mountain three times more; breathing out fiery vapours, and sending forth bright beams, it dimmeth the eyes.

Great is the Lord that made it; and at his commandment it runneth hastily.

He made the moon also to serve in her season for a declaration of times, and a sign of the world.

From the moon is the sign of feasts, a light that decreaseth in her perfection.

The month is called after her name, increasing wonderfully in her changing, being an instrument of the armies above, shining in the firmament of heaven;

The beauty of heaven, the glory of the stars, an ornament giving light in the highest place of the Lord.

At the commandment of the Holy One they will stand in their order, and never faint in their watches.

Look upon the rainbow, and praise him that made it; very beautiful it is in the brightness thereof.

It compasseth the heaven about with a glorious circle, and the hands of the most High have bended it."

The Hebrews made a clear distinction between the worship of God and the contemplation of His works. Early Greek philosophers similarly separated the study of Nature from that of personal deities, and sought for law and order in it. In the sixth century before the Christian era, Thales and Pythagoras first opened up those veins of speculative philosophy which occupied afterward so large a portion of Greek intellectual energy.

Both science and philosophy as systems of rational knowledge may thus be said to have had their beginnings in the Greek colony of Ionia in the sixth and fifth centuries B.C. Thales of Miletos was the founder of this Ionian school of philosophers and the first to give a general explanation of the universe based upon perception and thoughtful consideration, apart from mythology and traditional views.

Anaximander, a pupil of Thales, and the second of the physical philosophers, wrote the first Greek book on natural philosophy, and suggested that man had evolved from a lower animal ancestry. These Milesians were true inquirers whose science and philosophy were completely independent of ancestral authority or sacred doctrines. They directed their attention to problems of the natural world, and sought solutions of them by observation and thought without religious or divine attachment.

This purely secularist attitude separated the study of Nature from that of personal deities and their supernatural functions and influences. It represented the first attempt to direct philosophical thought away from religious faith in all personifying divine causes of phenomena to a realm in which endeavours to understand the world and man were works which took the place of worship. It is in this philosophy that the idea of Person is tacitly set aside or limited, and an impersonal Nature is conceived as a subject of study. The scope of natural philosophy or natural science was thus defined, with its objective character and invariable laws, discoverable by a proper and methodical application of the human intellect.

In the Dialogues of the tenth book of Plato's *Laws*, arguments are advanced, by the Socratic system of reasoning, to establish the existence of gods and their relationships to everything in the universe—animate and inanimate. The leader in the discussion was Plato himself, usually referred to as the "Stranger", and the scene was Crete more than two thousand years ago. A school of philosophers had arisen which studied natural phenomena and objects apart from supernatural agencies, and endeavoured to interpret the processes involved by submitting them to independent inquiry.

It was against the teaching of these materialists, of whom Democritus (468–370 B.C.) was the leader, that the main arguments were expounded. Disregard of the gods, or unbelief in their concern for human affairs, was held to be a danger to the State and a crime to be denounced by every law-abiding citizen and punished severely. Both Greeks and barbarians believed in the existence of the gods, and many accounts had been related from one generation to another as to their origin and ancestral associations. This was the basis of

the established faith, and any other outlook upon the world of Nature was condemned as heretical as well as socially dangerous. The words used by Plato near the beginning of his discourse express very clearly the differences between the scientific and theological attitude towards natural knowledge. They are today as truly typical of the two points of view as they were in the first recorded statement of the conflict between religion and science.

"It is the novel views of our modern scientists," said Plato, "that we must hold responsible as the cause of mischief. For the result of the arguments of such people is this—that when you and I try to prove the existence of the gods by pointing to these very objects—sun, moon, stars and earth—as instances of deity and divinity, people who have been converted by these scientists will assert that these things are simply earth and stone, incapable of paying any heed to human affairs, and that these beliefs of ours are speciously tricked out with arguments to make them plausible."

As evidence that the Sun and Moon were gods "beyond the shadow of doubt", Plato instanced the prostrations and devotions at their rising and setting by the Greeks and barbarians alike, and the prayers and supplications made to these luminaries. These arguments having been accepted by the polite interlocutors as convincing proofs of the existence of the gods, the next step was to show that they were all offsprings of mind and primary to the creation of the four so-called elements of the universe—fire, water, earth, and air—and the action upon them of forces of attraction and repulsion.

The starting principle or "soul" of the sense-world was derived from a discussion of all types of motion in the universe. Every celestial object which moved by itself—the Sun, Moon, stars and planets—was animated by soul and was, therefore, under divine guidance. "This soul—whether it is by riding in the car of the Sun, or from outside, or otherwise, that it brings light to us all—every man is bound to regard as a god." All mortal creatures are possessions of the gods, to whom belongs also the whole heaven and by whom all change and motion in all things are caused. Orderly movements and righteous thought and action are in kinship with good souls and with the gods which represent these qualities. At the head of this hierarchy is the "best soul", God, or "First Cause" that controls and indwells in all things everywhere, on Earth as well as in Heaven.

Plato's philosophic attitude towards the subject of celestial movements was that of a mathematician, and he assumed that the universe had been designed by its prime-mover on what he believed to be perfect mathematical principles. What may be said to be his

fundamental law is that celestial bodies move in circles—the perfect geometrical figure—unless diverted from their courses by evil influences. The movements were started and continued by a primary principle or soul, with the power of which the human mind alone could make abstract contact.

On the purely physical side, the conclusion thus reached by Plato was that a certain force was the cause of all celestial rotations and revolutions; and these were primarily circular in form. The basic idea is that things cannot move of themselves: they are without inherent power of action; or, in the phrase of physical science, matter has the property of inertia. This is expressed by Newton's First Law of Motion in the words "Every body tends to persevere in its state of rest or of uniform motion in a straight line unless it is compelled by impressed force to change that state". The only difference between this axiom of physics and Plato's is geometrical—a straight line taking the place of a circle.

Plato called the originating force the soul, and made it reside in god or gods in charge of celestial bodies and with benevolent influences upon human nature. The scientists whose teaching he condemned detached themselves from this association of natural properties with personal divinities; and they were thus the pioneers of the scientific method of inquiry by which the chief advances of natural knowledge have been made. As astronomical knowledge increased, the assumption of movements in circles proved to be untrue in fact and improbable in theory and had to be abandoned as the basis of a celestial system.

When Plato gave the name "soul" to the primary cause of all change and motion in all things he defined it as "the motion able to move itself". Two ideas are involved in this statement—a thing and a force which moves it. Movements can be studied and expressed in a system logically adaptable to the knowledge existing at any time, without bringing their cause into consideration. Everything in the universe is in motion—from the particles which constitute the atoms of all substances to the spiral nebulae in the furthermost depths of space.

Effects and actions can be measured and reduced to general principles or laws, without understanding their ultimate cause or giving it the attributes of the human mind. Newton's Law of Gravitation was a mathematical generalization which described mechanical movements of physical bodies by means of a force of attraction which varied directly as the product of their masses, and inversely as the square of the distances separating them. It was a deduction from observed laws of motion, and not an assertion of what motion in itself is apart from bodies moved.

Modern studies in atomic physics have proved that "mass" depends not only upon quantity of substance but also upon its velocity, and this conclusion has to be applied to cosmic masses as well as to their constituent particles. As all observable phenomena and effects are relative to one another and not absolute in their measurable values, a new concept of "space-time" was put forward by Einstein, in his general theory of relativity, as another way to account for the movements of bodies in what had the form of a spherical universe. This theory, of a "space-time" continuum, unlike that of Newtonian gravitation, renders it unnecessary to assume the existence of a medium which enables one body to act upon another anywhere in space and at any time.

Neither theory, however, is completely satisfactory in unifying all that is known about physical forces and their effects. Beginning with a single free particle, and discussing its behaviour in the presence of other particles, it is possible to interpret the universe in terms of pure mathematics and metaphysics without introducing a force of gravitation acting through a hypothetical ether. On this cosmological principle, all that exists are entities and motion, and upon these can be constructed a mental model, consistent with existing knowledge but not limited to it. In this field the mathematician uses his disciplined imagination to draw a natural system on rational lines, without introducing teleological aspects into the world picture.

All forms of matter, celestial or terrestrial, can be conceived as made up of particles responding in their movements to particular shades of a universal influence, or to their relations to absolute space and time. Neither this nor any other theory can, however, claim to express ultimate truth while factual knowledge continually increases and has to be interpreted in rational terms. It is obviously illogical to assume that what can be observed or proved to exist, by entering through the five gateways of the human senses, represents all that there is to know about the universe.

Natural science has advanced by bringing unknown properties and phenomena within the range of human perception; but whoever vast its field of exploration, and however refined the sensory means of analysis, perfect knowledge through such empirical methods of inquiry is philosophically unattainable. Observational and experimental scientists do not claim that they will ever apprehend the whole natural scene or comprehend its meaning. Their contributions are made by steps along "the solid ground of nature", and they are content with the discovery of what exists and what properties and relationships can be expressed as generalized principles or so-called laws of Nature.

This is the scientific way of submitting the operations of Nature

to factual analysis and theoretical synthesis, and the whole development of natural knowledge is based upon it. With what is known of the physical world, from the atom to the universe, through observation and experiment, the mind constructs an intellectual model or picture of the machine in its present form. The essential point in this method of reasoning is a groundwork of actualities, and not purely mathematical or metaphysical conceptions.

In Platonic philosophy all conditions of substance are reduced to ideas, and perfection is reached in the heavens and on the Earth when there is harmony between the object and the idea.

On this view pure Reason is the imperishable essence in the universe, and by it all natural things and relationships can be conceived independently of physical experience. If it be assumed that a universal mind exists, and that it is Omniscient and Omnipotent, then obviously this could formulate natural laws and relationships, before their discovery by observation and experiment at any epoch. If it is also conceded that products of the human mind are reactions to this supreme intelligence, then mathematical equations derived from abstract reasoning are as sound logically as those which co-ordinate observational experience.

Natural philosophers take a middle course by combining reason with empirical knowledge, or theory with experiment, and their assumptions are of a kind to be verified by experience in order to be established. They study effects of interactions between matter and motion, and are content to arrive at rational interpretations of them, even though these forms of knowledge may be far from ultimate reality. Plato made human thoughts and feelings prime-working motions partaking of the same driving power as that which keeps the stars and planets in their courses, and endowed with personality and intelligence. His prime-mover was the soul or spirit—an imperishable and universal essence or reality behind the visible universe, and to be worshipped as divine.

This Platonic conception of celestial movement was afterwards adopted by doctors of the Christian Church, who taught that angels carried the stars and planets on their shoulders or rolled them round the heavens, each taking care not to get in the way of the others. The Egyptian Christian, Cosmas Indicopleustes, who was a great traveller and died about A.D. 550, wrote a treatise entitled "Christian Topography". In it he opposed the conclusion that the Earth is a globe, and described its shape and the phenomena of the heavens in accordance with Holy Writ. "God," he said, "made the angels for his service, and he charged some of them with the motion of the air, others with that of the Sun, or the Moon, or the other stars, and others with the collecting of clouds and preparing the rain."

This, however, is only to give divine names to physical forces, or a single force, which produce observable effects. It belongs, like all other theological conceptions relating to the nature of the universe, to a different realm from that which can be explored by scientific inquiry. The approach to ultimate truth in these two fields differs greatly, because their standards of value are not expressed in the same units. One is measured by feeling and faith as to the nature of the divine influence: the other by knowledge gained as to the ways of working of natural machinery and the resulting effects.

III

ASPECTS OF CREATION AND THE COSMOS

The realm or region of space beyond the clouds has been viewed by most of the peoples of the Earth as the seat of their chief deities and the abode of immortal spirits. In ancient Egypt, however, the home of the gods was underground and not in the sky, and it was there that the dead were judged. In early Semitic mythology, also, the spirits of the dead dwelt in a gloomy cavern of the under-world. According to many traditional beliefs, Heaven as a place of supreme bliss was an earthly paradise in which primeval man lived happily with the gods in a Golden Age of the past.

In the Revelation of St. John the Divine, the last Book of the New Testament, the opposing forces in unending conflict between Good and Evil on the Earth are the Christian Church and the Roman Empire; and the visions lead to a new Heaven and a new Earth in which the land would become miraculously fertile and all creatures would live in perfect amity.

Science may rightly claim that it has fulfilled its part of the prophecy by so abundantly increasing the fruits of the Earth as to enable man to live under conditions of a new Garden of Eden. But the influences of his primitive evil instincts still prevent the human world from becoming one in spirit as well as in truth. In the Apocalypse of St. John a speedy return to these conditions was predicted in the form of a Messianic kingdom on Earth; but when the expectations were not realized Paradise was transferred to

Heaven, as the place which the spirits of the righteous dead shared with the angels.

There is clear evidence, especially in Chapter XII of the Apocalypse, that the writer made use of Babylonian and Egyptian mythology in his imagery and interpreted the configuration of the heavens astrologically by relating them to mundane history. His seven heavens were those recognized by the Jews, the highest being the abode of God and the most exalted angels; and his visions were a Revelation to him of their spiritual meaning.

When the human mind creates inspiring and fanciful ideas of this kind, and expresses them in art or literature, it is exercising its best functions and may reveal truths hidden to sensory vision. While, however, such revelations can go beyond the range of observation and provide a new understanding of ascertained knowledge, they must, to have any scientific value, take account of things and conditions as they are. For example, the exquisite lyrics and marvellous engravings of the poet and mystic, William Blake, are thus revelations to his mind to be judged not as natural truths but as symbolic pictures. How near or how far such ecstatic visions may represent ultimate reality is not for natural philosophers to say; but when they are held to explain observable conditions and events in the heavens, their values have to be tested by scientific standards of conformity to natural conditions.

The accounts of the process of Creation given in the Book of Genesis, like those of the last Book of the Bible, are therefore not now believed to be more than primitive conceptions of the origin of the heavens and the Earth. They convey grand poetic messages from one mind to another, and can be appreciated as such without attempting to reconcile them with observational knowledge in the past or the present. To the natural philosopher the aspects of the heavens, and the varying positions of some objects in them, are the facts upon which it is possible to build an organic scheme of the universe and to suggest how the cosmic order came to be developed out of chaos. Science knows nothing about the divine purpose or meaning of the actual beginnings of things and is content to leave this aspect of the cosmos to the province of divine revelation.

There is dignity and beauty in the account of Creation in the First Chapter of Genesis, which begins with the words:

> "In the beginning God created the heaven and the earth. Now the earth was unformed and void, and darkness was upon the face of the deep; and the spirit of God hovered over the face of the waters. And God said: 'Let there be light.' And there was light. And God saw the light, that it was good: and

> God divided the light from the darkness. And God called the light Day, and the darkness he called Night. And there was evening and there was morning, one day." (Jewish translation of the Masoretic Text.)

By beginning with the creation of light, a sublime idea dominates the scheme in whatever way it is interpreted. In general, the order of creation as recorded in the chapter may be said to correspond to that derived from scientific knowledge of the evolution of the Earth and of forms of life upon it, leading up to man. This, however, does not mean that the text must be accepted literally as a statement of fact, but only as revelation distinct from observation.

The accounts of the creation of the heavens and the Earth, and other events recorded in early chapters of the Book of Genesis, were derived from legends which were part of the religious beliefs of other peoples, long before the earliest settlement of the Hebrews in Palestine, about 2000 B.C. The legends were recorded in various forms on baked-clay tablets of Assyria and Babylonia, and are essentially the same as in Genesis. One of these tablets describes the time "when the heavens were not, when there were no plants, and before the gods had come into being, and when the water-deep was the source and origin of all things". [*A Guide to the Babylonian and Assyrian Antiquities*. (British Museum.)] Others deal with the formation of the Earth and the firmament above it; the creation of the stars; the establishment of the year, which was divided into twelve months, the Moon being appointed "to determine the days"; the filling of the Earth with beasts and cattle of the field and with creeping things by the god Marduk (Merodach of the Bible); and the creation of man, to whom the god says:

> "Thy heart shall be pure before thy God, for that is what is due to Him. Thou shalt pray, and shalt make supplication, and bow low to the Earth early in the morning. The fear of God begetteth mercy, offerings prolong life, and prayer is the propitiation of sin. Speak no evil against thy friend and neighbour. When thou hast made a vow, withhold not that which thou hast vowed."

The Babylonian legend of the Creation is divided into seven sections or tablets, each containing on an average one hundred and forty lines and intended to describe the events of one "day" of Creation. The British Museum has in its collections almost a complete set of these "Seven Tablets of Creation" discovered among the



From *Astronomical Myths.* JOHN F. BLAKE.

THE HOMERIC COSMOS. The Earth had the form of a disc which was washed on all sides by the ocean as a river. Above it was a solid celestial dome beneath which the Sun and stars were carried by chariots supported by the clouds. Under the surface of the Earth was Tartarus—a dark abyss or firmament in which lived the Titans, the enemies of the gods, their world being as much below the surface as heaven was above it. Later, this became to the Greeks the infernal regions and the abode of Hades. Above Tartarus were the foundations of the land and sea, with the pillars which kept heaven and earth asunder, in charge of Atlas—the bearer or endurer.

ruins of the palace and library of Ashurbanipal, who reigned in Nineveh in the seventh century B.C. These represent the oldest known copies of the legends, but the original form of the Babylonian and Assyrian story of Creation goes back long before that time; so that the Semitic Babylonians were only the borrowers and not the inventors of this remarkable tradition.

These and other records represent primitive beliefs and worship common to groups of people in a particular region at certain stages of civilization, and have no special claim to divine revelation. The Hebrews did not originate these traditions, but shared them with

neighbouring peoples and recorded them in the Old Testament, giving them at the same time an exalted religious significance.

The next stage in the development of ideas as to the origin and order of celestial bodies belongs to the Greeks and is described by Plato (428–348 B.C.) in one of his most significant works entitled *Timaeus*. This work records a discussion in which the main theme was the creation of the universe. Timaeus, who by tradition was skilled in mathematics and astronomy, took part in the discussion with Socrates and two other interlocutors. He is made to declare "that the Cosmos has verily come into existence as a Living Creature endowed with soul and reason owing to the providence of God".

Plato's exposition of the discussion reads:

> "When the Father who begat the world saw the image which he had made of the Eternal Gods moving and living, he rejoiced; and in his joy resolved, since the archetype was eternal, to make the creatures eternal so far as was possible. Whereupon he made an image of eternity, which is time, having an uniform motion according to number, parted into months and days and years, and also having greater divisions of past, present and future.
>
> "These all apply to becoming in time, and have no meaning in relation to the eternal nature, which ever is and never 'was' or 'will be', for the unchangeable is never older, or younger, and when we say that he 'was' or 'will be' we are mistaken, for these words are applicable only to becoming, and not to true being. . . . These are the forms of time, which imitate eternity and move in a circle measured by number.
>
> "Thus was time made in the image of eternal nature; and it was created together with the heavens in order that if they were dissolved it might perish with them. And God made the Sun and the Moon and five other wanderers, as they are called, seven in all, and to each of them he gave a body moving in an orbit, being one of the seven orbits into which the circle of the ether was divided. He put down the Moon in the orbit which was nearest the Earth, the Sun in that next, the morning star and Mercury in the orbits more opposite to the Sun, but with equal swiftness—this being the reason why they overtake and are overtaken by one another.
>
> "And their bodies became living creatures and learnt their appointed tasks, and began to move, the nearer more swiftly, the remoter the more slowly, according to the diagonal movement of the other. And since this was controlled by the movement of the same, the seven planets in their course appeared to

describe spirals, and that appeared fastest which was slowest, or that which overtakes others appeared to be overtaken by them.

"And God lighted a fire in the second orbit from the Earth, which is called the Sun, to give light over the whole heaven, and to teach intelligent beings that knowledge of number which is derived from the revolution of the same. Thus arose day and night, which are the periods of the most intelligent nature; a month is created by the revolution of the Moon, a year by that of the Sun.

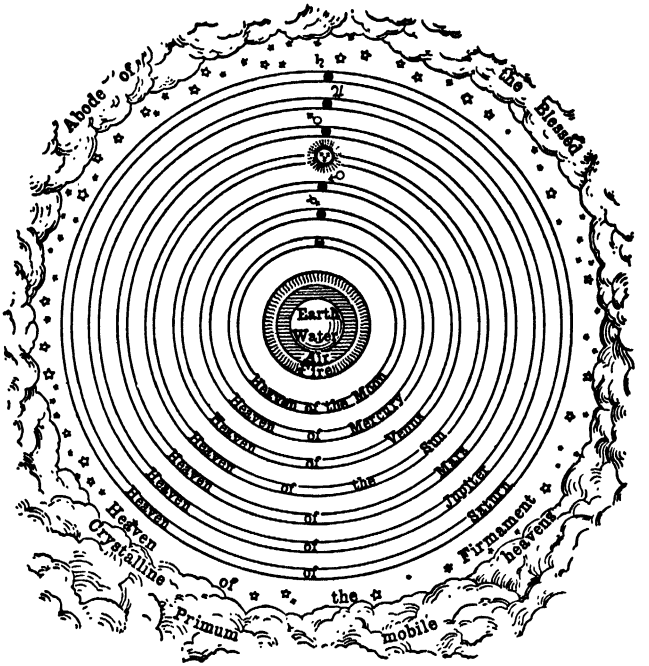
"Other periods of wonderful complexity and length are not observed by men in general; there is a movement of a cycle or perfect year, at the completion of which they meet and coincide. To this end the stars came into being that the created heavens might imitate eternal nature.

"The gods were made in the form of a circle which is the most perfect figure and the figure of the universe. . . . Two kinds of motion were assigned to them—first the revolution in the same and around the same in peaceful unchanging thought of the same, and to this was added a forward motion which was under the control of the same.

"Thus the fixed stars were created, being divine and eternal animals, revolving on the same spot, and the wandering stars in their courses were created in the manner already described. The Earth, which is our nurse, clinging around the pole extended through the universe, he made to be the guardian, artificer of night and day." [From B. Jowett's Translation. (Oxford, 1892.)]

This attempt to understand the process of creation, and to describe the places and movements of celestial objects, is rich in imagery and suggests the idea of law and order in the universe, but the view presented is not precise enough to have real scientific value. It is a philosophic speculation of the design, and not a scheme to bring observed facts into a unified natural system. In this respect it elaborated early ideas of a mystical kind found in the myths and tradition of many other peoples, such as the Babylonians and their Semitic neighbours. All such accounts of the nature and structure of the universe are now understood to express spiritual apprehensions or revelations, and not necessarily observed or observable truths. They belong to theology rather than to natural science, and their origin is feeling associated with reason.

To account for the movements of the Sun, Moon and planets as seen on the background of the stars, and with a fixed Earth as the



Ptolemy's astronomical system, with the Earth at the centre and the celestial spheres in the order followed by Dante and Milton.

centre, ancient astronomers conceived various systems or designs of the working parts of a celestial machine. A famous mathematician, astronomer and geographer, Claudius Ptolemaeus, or Ptolemy, who worked at Alexandria in the second century A.D., advanced a theory of the mechanism, which was accepted for fourteen centuries afterwards, by which the Sun, Moon and five planets move along their appointed places in the celestial system. In this Ptolemaic blue-print of the celestial machine the Earth is shown as a stationary globe in the centre of the heavens, with these prominent objects revolving around it, each in its own fashion and all moving around the Earth once a day with the dome of the fixed stars.

The Greek astronomer, Aristarchus, in the third century B.C., taught that the Earth revolved around the Sun and not the Sun around the Earth, but his ideas were speculative rather than scientific. On the other hand, Hipparchus (190–120 B.C.), the most

renowned astronomer of antiquity, believed the Earth to be the material centre of the universe, and this idea was elaborated in detail by Ptolemy. In the Ptolemaic theory of the construction of the universe, the Sun and the planets were supposed to revolve around the Earth in their own transparent hollow "spheres", and on the outermost sphere the stars were fixed.

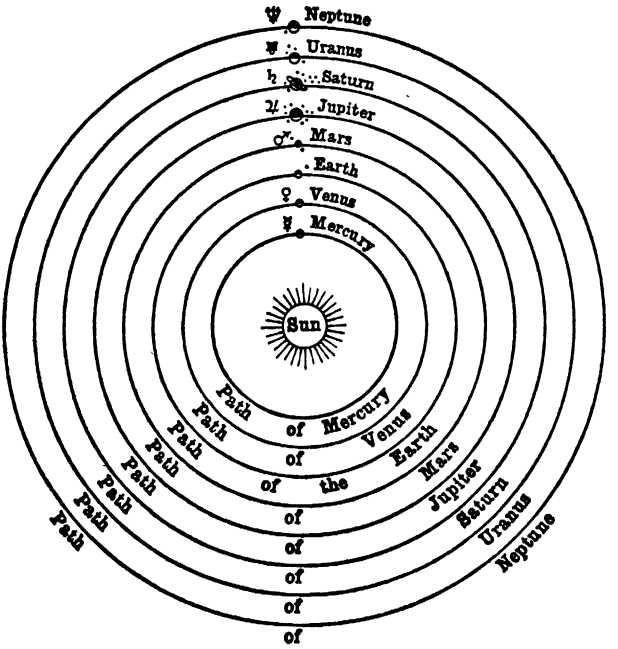
This scheme involved very complicated movements of the planets, but if such movements were assumed to exist the theory could be used to predict the positions of the Sun, Moon and planets to a close degree of approximation and was, therefore, so far satisfactory. It was indeed accepted and unquestioned, by theologians and astronomers alike, for more than fourteen hundred years, as a true picture of the places and movements, both real and apparent, of all celestial objects; and to doubt it was regarded as gross impiety.

Ptolemy described his scheme in the earliest systematic treatise on astronomy in which he brought together the scientific knowledge of the subject acquired by his predecessors and co-ordinated it with his own observations and conclusions. When the seat of learning passed from Alexandria to Arabia, the work was translated into Arabic and given the title of the *Almagest*—signifying "The Greatest" encyclopaedia of astronomy; and so it was in fact and theory until the fifteenth century.

As the Ptolemaic system placed the Earth in the centre of the universe, and everything in the universe was believed to have been created for the benefit of man, it was accepted by theologians and philosophers as an incontrovertible truth. Though this doctrine continued to be taught in universities after the revival of classical learning in Europe, the idea of a rotating earth was debated from time to time as a speculation, but without applying it as a touchstone to test the genuineness of observational knowledge.

It was left to Nicholas Copernicus, who was born at Thorn, Poland, in 1473, to show that the complicated apparent and real movements of the planets in celestial space could be better explained by regarding the Earth as a rotating globe revolving around the Sun: as a planet in a system which included the orbits of the other planets, from Mercury to Saturn. This theory involved great revolution of thought about the place of the Earth and man in the material universe; for it degraded them almost into physical insignificance. It meant that the Sun was fixed, and the Earth revolved around it as a member of the solar system, instead of the Earth being fixed and all celestial objects doing, as it were, service to it and for man.

Copernicus was not only a great scholar but also occupied leading positions in ecclesiastical and civil administrations, in addition to being renowned for his astronomical knowledge. He was brought up



Order of the planets in relation to the Sun at the centre, as represented in the Copernican system. The diagram does not represent the actual distances of the planets, or the shapes of their orbits.

by an uncle, Bishop Lucas Watzelrode of Heilsburg, and in 1501 was elected to a canonry at the cathedral city of Frauenburg. Here he embarked on the study of medicine and did much of his best work in mathematics and astronomy. It was at the seat of his uncle, Bishop Lucas, in 1509, that Copernicus first produced a treatise in which he laid down the principles of the heliocentric theory. But he was not able to concentrate attention upon the composition of the great work of his life, *De revolutionibus orbium coelestium*, until later, and it was not finished until about 1530. His Polish friends, including several bishops, urged him to publish his "revelation of the truth", but he hesitated to do so, through fear of ridicule or suggestions of heresy.

A young mathematician named Rheticus, from Wittenberg, became a fervent advocate of the Copernican theory, and its active apostle. He obtained a copy of the manuscript of the work

from his master, and managed to get it published with a preface in place of that written by Copernicus, in which the conclusions were put forward as mere hypotheses without any basis in reality. The work appeared with this anonymous preface in the spring of 1543, and tradition says that when Copernicus died on May 24 of that year, he reached out and laid his fingers on this great achievement of his creative spirit.

The Copernican system of a rotating Earth revolving annually around a fixed Sun afforded a simple explanation of the daily march of celestial bodies across the sky. It revealed that the turning of the concentric spheres in which these objects were embedded was not real but only apparent. It was no longer necessary, therefore, to accept the view that the stars, sunk in immeasurable distances in space beyond the outermost planet—Saturn—then known, were endowed by their *Primum Mobile* with sufficient velocity to move around the Earth in twenty-four hours. Instead of the universe being conceived as a self-contained finite structure, with the Earth as its centre, it became infinite in its dimensions. Heaven as the seat of God and the abode of the blessed could no longer be found a place in the Empyrean of pure light and fire surrounding the sphere of the stars, but was lost in the idea of infinitude. It is thus not surprising that the Catholic Church regarded the Copernican theory as destructive of religious faith and contrary to the Holy Scriptures. The work in which the theory was described was declared heretical in 1616 and placed on the *Index Librorum prohibitorum*, where it remained as suppressed truth until 1835.

The first astronomical observations which provided convincing evidence in support of the Copernican theory were those made by Galileo in 1610. He used a small telescope having about the magnifying power of a modern field-glass. He discovered that the Sun was not immaculate and changeless, as had been taught since the days of Aristotle, but had occasional dark clouds or spots upon it and that they rotated with the Sun. He found that the Moon was not the perfectly smooth globe it had always been believed, but had mountainous ranges and rings similar to those on the Earth, as well as dark spaces which he thought were lunar seas. His observations of four satellites revolving around the planet Jupiter, in a similar way to the monthly revolution of the Moon around the Earth, brought new heavenly bodies into the field of visual knowledge.

Until this discovery, the Sun and Moon, with Mercury, Venus, Mars, Jupiter and Saturn, were the only celestial objects known to change their positions on the background of the fixed stars. The addition of four new "wandering stars" to this mystic number seven

seemed to be so contrary to crystallized conviction that it was regarded as unreal, and an optical illusion, due to the use of a telescope.

The four satellites observed by Galileo in different positions close to the east and west of Jupiter, on the nights of Jan. 7–17, 1610, had their sizes visually magnified by the use of the telescope, whereas the stars never appear other than as bright points of light, whatever optical power is used. They belonged, therefore, to the system of the planets, and their particular significance in connection with the Copernican theory was that the Jovian retinue afforded an example of a set of objects revolving around a central body, each in its own path, like planets revolving around the Sun. Galileo used this comparison to support the theory when he wrote :

> "In this circumstance we have a notable and splendid argument to remove the scruples of those who can tolerate the revolution of the planets around the Sun in the Copernican system, yet are so disturbed by the motion of our Moon round the Earth, while both accomplish an orbit of a year's length about the Sun, that they consider that this theory of the constitution of the universe must be upset as impossible; for now we have not one planet only revolving about another, while both traverse a vast orbit about the Sun, but our sense of sight presents to us four satellites circling about Jupiter, like the Moon about the Earth, while the whole system travels over a mighty orbit about the Sun in the space of twelve years."

Though astronomical discoveries made by Galileo were appreciated by some leaders of thought of his time, his use of them in support of the Copernican theory brought him into conflict with the Catholic Church. He insisted upon the announcement of observable truths, however disturbing they were to theological authority. In 1632 he presented a four-day discussion of a Socratic kind on the new and the old views of the scheme of the universe in a famous work entitled *Dialogues Concerning the Two Principles of the World.* In this work the assumptions of Aristotle and the views of Ptolemy, as to the fixity of the Earth, are debated in detail and confuted by mathematical and physical evidence, presented by one of the interlocutors. The new astronomy testified to the truth of the Copernican theory, and established it by the witness of verified observation.

At this stage, when Galileo's discoveries and conclusions based upon them could not be refuted by conventional, philosophic or theological argument, his enemies in the Church took action against his teaching. They were constituted into a special commission of the

Inquisition, with the result that he was indicted by a tribunal in 1633, and condemned by an assembly of cardinals and high officials of the Church, for his heretical depravity. The book of his *Dialogues*, which had been widely read, was prohibited by public edict, and the doctrine supported in it by scientific evidence was denounced as false and pernicious. The main charges brought against Galileo were stated by the Tribunal to be:

> "The proposition that the Sun is the centre of the World and does not move from place is absurd and false philosophically and formally heretical, because it is expressly contrary to Holy Scripture.
>
> "The proposition that the Earth is not the centre of the world and immovable, but that it moves, and also with a diurnal motion, is equally absurd philosophically and theologically considered, at least erroneous in faith".

By the sentence pronounced upon Galileo he had to recant everything he had written or said upon these subjects, and declare that "I abjure, curse, and detest the aforesaid errors and heresies, and generally every other error and sect whatsoever contrary to the said Holy Church". He was ill and seventy years of age at the time of the trial and could, therefore, scarcely be expected to do other than accept the mental suffering involved in this recantation, combined with an order to live in solitude and not to hold any discussion with visitors. The shame lies not in Galileo's forced denial of what he knew to be scientific truth, but in his theological persecutors, whose object was to humiliate him and suppress views of the universe in conflict with what was regarded as sacred revelation. So it must always be, until freedom of thought and freedom from the fear of its expression are recognized as fundamental principles of individual liberty and the dignity of human society.

There was no hostility between science and the Muslim faith, largely because the Arabs concerned themselves with the observational uses of astronomy and gave little attention to theory. They adopted the crystalline heavens of Aristotle, and the Ptolemaic system of the universe, without question, and were able to make notable advances in astronomical instruments and measurements in a period when the peoples of western Europe were in darkest ignorance.

Following the suppression of the philosophic schools of Athens by the Byzantine Emperor Justinian, in the year 529, some Greek men of science went to Persia, and there for a couple of centuries carried on the intellectual learning of Greece. After the Muslim conquest of Persia, and from the nineth to the fifteenth centuries, there

was a great awakening of interest in all branches of science, and during that period the Arabs cultivated the advancement of natural knowledge with conspicuous success. Their gifts and learning were carried into Spain and other European countries, and influenced such great teachers as St. Thomas Aquinas, Albertus Magnus, and that paragon of scientific learning in his time, Roger Bacon.

It was in the latter half of the eleventh century that Omar Khayyam lived. Few who admire his poetic genius, through Edward FitzGerald's translation of his *Rubaiyat*, know that his most original works were not in literary fields but in those of mathematics and astronomy, and that he devised a very accurate form of the calendar. Three quatrains in the familiar translation (fourth edition) of his poem refer to the sky and objects upon it:

> "Up from Earth's Centre through the Seventh Gate
> I rose, and on the Throne of Saturn sate,
> And many a Knot unravel'd by the Road;
> But not the Master-Knot of Human Fate.
>
> . . . . .
>
> Ah, but my Computations, People say
> Reduced the Year to better reckoning?—Nay,
> 'Twas only striking from the Calendar
> Unborn To-morrow, and dead Yesterday.
>
> . . . . .
>
> And that inverted Bowl they call The Sky,
> Whereunder crawling coop'd we live and die,
> Lift not your hands to *It* for help—for It
> As impotently moves as you or I."

The opening line of the second quatrain refers to Omar's reformation of the calendar, which Gibbon, in his *Decline and Fall of the Roman Empire*, described as

> "a computation of time which surpassed the Julian, and approached the accuracy of the Gregorian style".

The spirit of these passages, and of the whole of Omar's poem, is obviously different from that represented in most references in literature to celestial objects or events, and their reflections in human life. There has, indeed, been much discussion whether the poem should be regarded as the work of a degraded voluptuary or a sublime philosopher. A leading authority upon Omar, Prof. E. B. Cowell, who introduced FitzGerald to the *Rubaiyat* in 1846, said that he admired his work as literature, as he admired Lucretius, but could not take him as a guide. The relation between the two

philosopher-poets is expressed as follows in the preface of the fourth edition of FitzGerald's translation:

> "Lucretius, indeed, with such material as Epicurus furnished, satisfied himself with the theory of a vast machine fortuitously constructed, and acting by a Law that implied no Legislator; and so composing himself with a Stoical rather than Epicurean severity of attitude, sat down to contemplate the mechanical Drama of the Universe which he was part Actor in; himself and all about him (as in his own sublime description of the Roman Theatre) discoloured with the lurid reflex of the Curtain suspended between the Spectator and the Sun".

In contrast to Omar, who found no virtues in the heavens themselves, except those of wonder and beauty, Dante (1265–1321) combined religion and science in his descriptions of them.

Dante was not only a typical university scholar of the period but also a poet who made accurate use of existing scientific knowledge. He was steeped in the learning of his times, and he combined this knowledge, with mysticism and Christian faith, in his immortal poem, the *Commedia*, which, after his death, was given the title of *The Divine Comedy*. The Theme opens with Dante being met in a gloomy forest by the poet Virgil, who promises to show him the punishments of Hell, and those of Purgatory, after which he is conducted into Paradise. The three stages of his journey are represented in the *Inferno*, the *Purgatorio* and the *Paradiso*.

To Dante, Aristotle was the master mind of all time. He leads the list of the philosophers mentioned in the *Inferno*:

> "Then when a little more I raised my brow,
> I spied the master of the sapient throng,
> Seated amid the philosophic train.
> Him all admire, all pay him reverence due.
> There Socrates and Plato both I mark'd,
> Nearest to him in rank, Democritus,
> Who sets the world at chance, Diogenes,
> With Heraclitus, and Empedocles,
> And Anaxagoras, and Thales sage,
> Zeno, and Dioscorides well read
> In Nature's secret lore. Orpheus I marked
> And Linus, Tully and moral Seneca,
> Euclid and Ptolemy, Hippocrates,
> Galenus, Avicen, and him who made
> That commentary vast, Averroes."

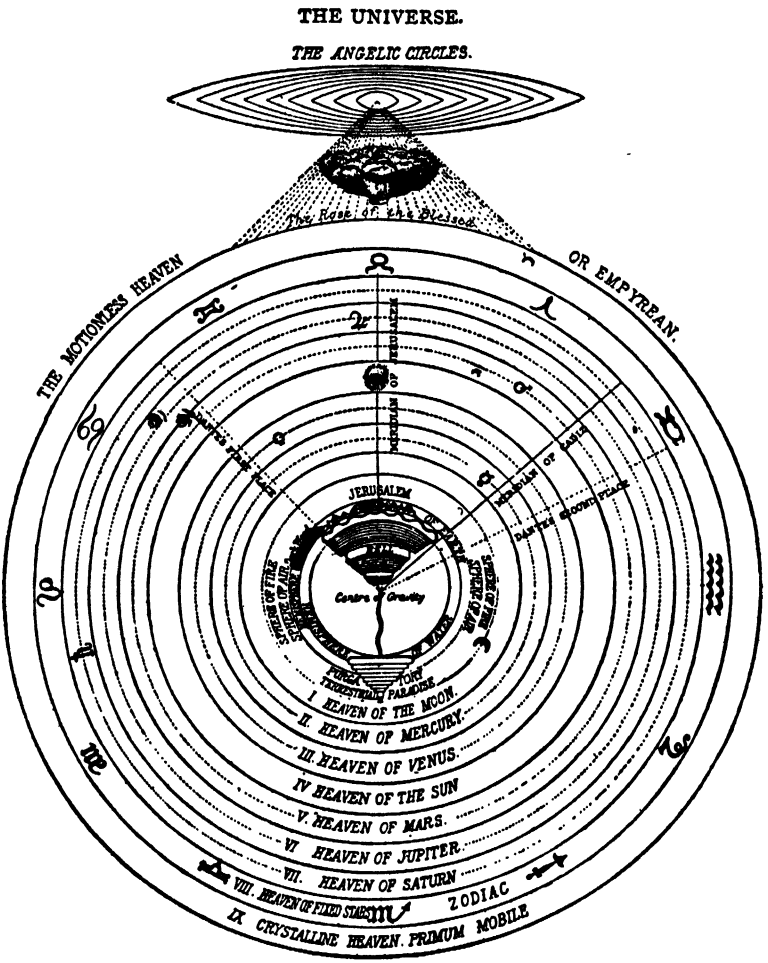
[From Carey's translation of the *Divine Comedy*. (Bohn's Standard Library, 1909.)]

When Virgil leaves Dante on the summit of the Earthly Paradise, Beatrice guides him through the celestial spheres, which are described according to the astronomy and theology of the time. The outermost of ten heavens is the Empyrean—the heaven of pure light and the seat of the Godhead. Within it are nine celestial spheres, the first in order below the Empyrean being the *Primum Mobile*, which bounds the material universe. Then come the heaven of the fixed stars and the seven lower heavens of Saturn, Jupiter, Mars, the Sun, Venus, Mercury, and the Moon, which are kept in motion "by blessed movers", or angels. Dante is finally taken to the heaven of the fixed stars, and apostrophizes the constellations, stating that the Sun was in the constellation of the Twins when he was born, and thus fixing the date of his birth. In 1265 the Sun entered this constellation on May 18 and left it on June 17.

Dante's ideas of the Celestial Universe were derived from the work of Aristotle, known to the Middle Ages in Arabic and in Latin translation under the title *De Caelo et Mundo*, by which Dante refers to it; although on occasion he may be taken to refer to the work with the same title by Albertus Magnus (1193–1280). Albertus was a voluminous writer, and the first Schoolman and great Aristotelian scholar. He was the teacher of Thomas Aquinas (1225–1274); and to these two scientists and theologians belongs the credit of being the first to reconcile the Christian and Aristotelian philosophies.

Much interesting information relating to the astronomical knowledge of Dante is contained in *A Dictionary of Proper Names and Notable Matters in the Works of Dante*, by Paget Toynbee (Oxford 1898), and is here digested. The system of the universe described by Aristotle and followed by Dante was that worked out by Ptolemy in his famous astronomical treatise, the *Almagest*. Each of the concentric spheres revolved around an immovable Earth at its own rate below the Empyrean, with the ninth heaven, the *Primum Mobile*, or Crystalline Heaven, as understood by Dante, being the origin of the motion of all the others.

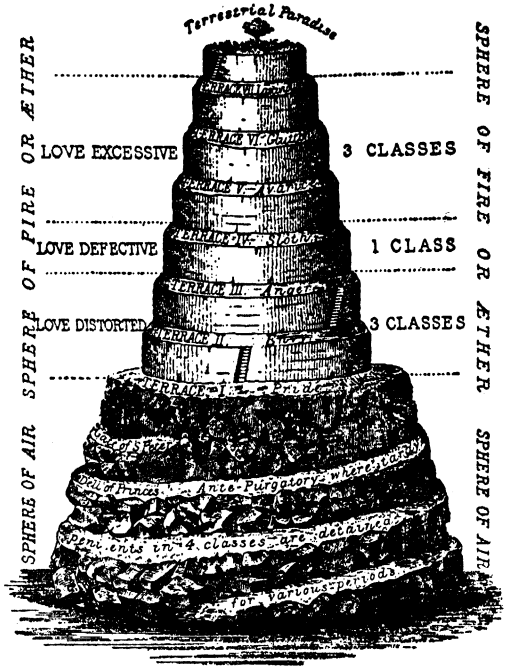
The eighth Heaven of this Universe of Dante is that of the fixed stars, and it had to be given a special rate of revolution to account for a long-period backward apparent movement of the stellar sphere, named the "Precession of the Equinoxes". This was discovered by the Greek astronomer, Hipparchus of Nicaea (161–126 B.C.) whose observations and results were the basis of the astronomical system of his successor and disciple, Ptolemy. Hipparchus estimated the annual precessional movement to be 36″ (thirty-six seconds of



From *A Shadow of Dante.* MARIA FRANCESCA ROSETTI.

DANTE'S UNIVERSE. This picture was the first complete representation of the structure of the Christian European Cosmos. The immovable globe of the Earth was at the centre of the Universe. The eastern hemisphere was chiefly land, with Jerusalem at the central point, and the western was almost wholly ocean waters upon which was the island Mount of Purgatory. To reach this in the subterranean journey, the Pit of Hell had to be passed through and the mountain climbed to the place of Terrestrial Paradise. From this mundane summit the ascent was through the nine heavens to the timeless all-containing Empyrean.

THE PURGATORY



From *A Shadow of Dante.* MARIA FRANCESCA ROSETTI.

DANTE'S MOUNT OF PURGATORY. The shores of this symbolic structure were washed by the vast Western Ocean, across which departed souls were piloted in an angelic bark. At the base is the mundane sphere of air, with the transitional Gate of St. Peter leading upward through the sphere of fire or ether to the terrestial paradise. The slopes of the Mount were thought to be irradiated by the constellation of the Southern Cross, four stars of which symbolized Prudence, Justice, Fortitude and Temperance.

arc), which would amount to about one degree of angular measurement in a century, and was adopted by Dante as the rate of movement of his Stellar Heaven.

It is now known that Hipparchus under-estimated the annual angle of precession, which is 50 seconds of arc and not 36 as given by him; but this does not alter the fact that Dante took the astronomical effect into account when he gave the concentric circle of his Stellar Heaven a special period of revolution apart from the movements of the planets.

Within the Eighth Heaven are the heavens of the seven planets, Saturn, Jupiter, Mars, the Sun, Venus, Mercury and the Moon, all having, besides the movement common to all, their special revolutions. The movement is not by inanimate gravity, but by the will of a supernatural being, an angel or intelligence, each inhabiting a separate heaven (*Par.* ii, and *Conv.*). The motion of the planets is the force of their thought. This is the influence which astrologers attribute to planets and constellations as exerting certain tendencies and inclinations upon life.

Dante obtained the data for his knowledge of the planets from a notable work by the Arabian astronomer, Alfraganus. He himself had calculated the periods for Saturn, Jupiter, Mars, the Sun, Venus, Mercury, and the Moon. The working of the system is explained to Beatrice (*Par.* xxvii, 78–120).

Alfraganus (Alferghano Ahmad ibn Muhammad ibn Kathir, al Ferghani, so-called from his birthplace of Fergana in Sogdiana, now Samarkand), whose account of astronomy was used by Dante, was a celebrated Arab astronomer who flourished at the beginning of the ninth century of our era. He wrote in Arabic on sundials, the astrolabe, and the elements of astronomy; the last was a work in thirty chapters based on the principles of Ptolemy. His work was translated into Latin, it is supposed about 1143, by Johannes Hispalensis, under the title of *Alfragani Elementa Astranomica*, or, alternatively, *Liber de Aggregatione Scientiae Stellarum.* This work became very popular, as is shown by the large number of manuscripts still in existence, and was in common use in the Middle Ages. Three printed editions appeared, at Ferrara (1493), Nuremburg (1537) and Paris (1546). Other and independent versions appeared in 1590 and 1669.

In addition to relying generally for his astronomical knowledge on Alfraganus, Dante makes two specific references to him or his work. He quotes him as his authority for the sizes of the Earth and Mercury (*Conv.* ii, 14), and refers to the *Elementa*, under the title *Libra dell' Aggregazione delle Stelle*, as the authority for the demonstration of the threefold motion of the Heaven of Venus.

In *Paradiso*, xxvii (Carey's translation, lines 131–134), Dante is believed to have referred to the reform necessary in the calendar, afterwards instituted by Pope Gregory XIII, in 1582. The difference between the year of 365.25 days of the Julian calendar, and the tropical year of 365.24 days representing the interval between two successive returns of the sun to the vernal equinox, is one hundredth part of a day. If it were neglected in the calendar January would, in the course of time, cease to be a winter month. Dante's words, as rendered in Carey's translation (*P.* xxvii, lines 131–134) were:

"Yet before the date,
When through the hundredth in his reckoning dropt,
Pale January must be shoved aside
From Winter's calendar."

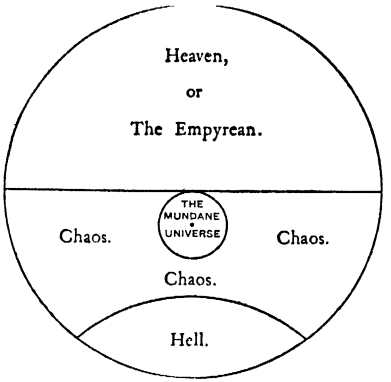
Chaucer (1340–1400) was another astronomer-poet who was indebted to Arabian science for much of the astronomical knowledge revealed in his works. In the last quarter of the fourteenth century, he won for English literature a distinctive place in the history of letters, such as had been held since the Norman Conquest by the literature of France and Italy. He was the first great master of English verse, and his poems contain many references to celestial objects and movements, chiefly from the point of view of their relationships to human life and events. The planet Saturn is thus associated with a malign influence; the Sun's position in the zodiac at different times of the year is mentioned; also the *Primum Mobile*, or motive power of the system of the universe described by Ptolemy, to whom Chaucer refers; and within it are the celestial spheres carrying the fixed stars, the six planets, the Sun, and the Moon. In the Franklin's story in the *Canterbury Tales*, the zodiac is placed in the outermost of the nine spheres or circles, and the astrologer is represented as calculating the precession of the equinoxes by the distance between the true equinoctial point in Aries and the bright star Alnath. His words were:

For his equacions in every thyng;
And by his eighte speere in his wirkyng
He knew ful wel how fer Alnath was shove
Fro the heed of thilke fixe Aries above,
That in the nynte speere considered is.

[*The Works of Geoffrey Chaucer*, edited by Alfred W. Pollard, H. Frank Heath, Mark H. Liddell, W. S. McCormick. (London: Macmillan & Co., Ltd.).]

In his poem, *The Complente of Mars*, Chaucer refers to the planet Venus being in conjunction with the planet Mars in the zodiacal sign of Taurus, and to the sign of Gemini.

Chaucer's prose writings included a *Treatise on the Astrolabe* written for the instruction of "Lytel Lowys my son". This is a simple and clear description of the parts of the oldest form of astronomical instrument and their uses in measuring altitudes of stars and other celestial objects for the determination of latitude and time. The treatise was based upon a Latin translation of a work by a ninth-century Arabian astronomer, Messahalla, entitled *De Compositione*



From *The Poetical Works of John Milton.* DAVID MASSON.

MILTON'S UNIVERSE. The Mundane Universe is the stellar system bounded by the Milky Way.

et Utilitate Astrolabii, supplemented by extracts from a treatise written in the thirteenth century by an English mathematician and astronomer, John of Halifax or Joannes de Sacro Bosco. This work was entitled *Tractus de Sphaera*, and the astronomy in it was derived from Alfraganus' work on astronomy already mentioned, which was translated from Arabic into Latin in the twelfth century and was the basis of Dante's knowledge of astronomy as well as that of other European writers.

Three centuries after Dante, Milton (1608–1674) in *Paradise Lost* described many astronomical objects and phenomena. His picture of the universe included the three regions of Heaven, or the Empyrean, Chaos, and Hell, with a New World or Starry Universe attached to Heaven by a single cord:

> "Far off the empyreal Heaven, extended wide
> In circuit, undetermined square or round,
> With opal towers and battlements adorned
> Of living sapphire, once his native seat,
> And, fast by, hanging in a golden chain,
> This pendant world, in bigness as a star
> Of smallest magnitude, close by the moon."

This poetical description of divisions of universal space is of particular interest, because the New World which hangs drop-like from

the Empyrean represents our starry universe in Milton's scheme: "All that Universe of orbs and galaxies which man's vision can reach by utmost power of telescope, and which even to his imagination is illimitable."

Upon his second visit to Florence, during his continental journey in 1638–1639, Milton obtained permission to meet Galileo, who was then seventy-five years of age and blind, in his villa near Arcetri. "There it was", he wrote a few years later, "that I found and visited the famous Galileo, grown old, a prisoner to the Inquisition, for thinking in astronomy otherwise than the Franciscan and Dominican licensers thought." His talks with Galileo, and possibly what he saw with Galileo's small telescope, are reflected in several well-known lines in *Paradise Lost*. Thus, referring to Satan's ponderous shield, he says:

> "The broad circumference
> Hung on his shoulders like the moon, whose orb
> Through optic glass the Tuscan artist views
> At evening from the Top of Fesole,
> Or in Valdarno, to descry new lands,
> Rivers or mountains, in her spotty globe."

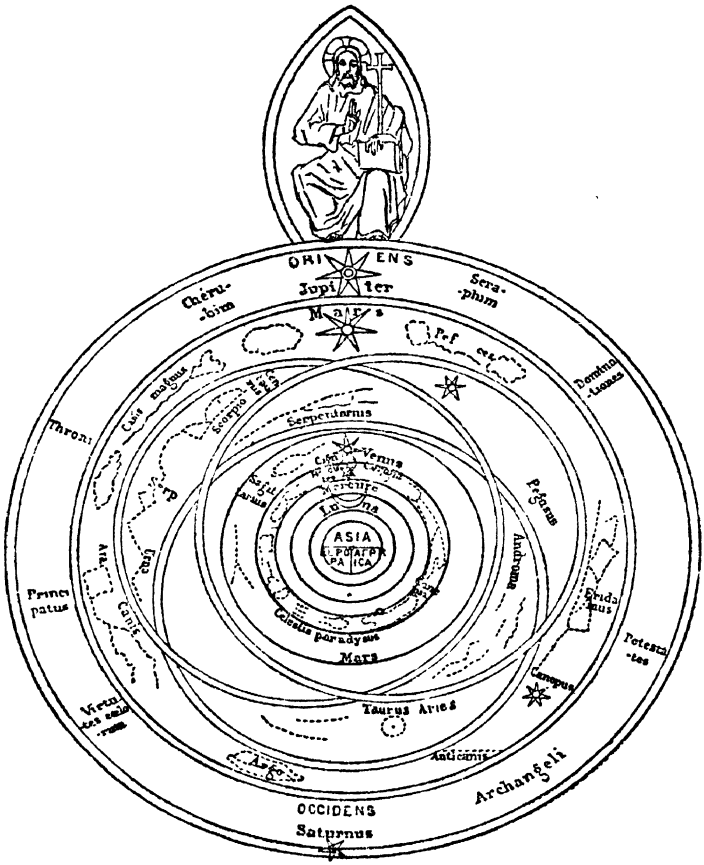
(Fiesole is a hill above Florence, and Valdarno, the valley of the Arno, is the valley in which Florence lies.)

Milton believed himself to be inspired, in the same way that biblical writers are understood to have been inspired in general Christian and Jewish teaching. He had no doubt himself that God had inspired him, as He had the prophets of the Old Testament.

In the seventh book of *Paradise Lost*, after referring to the creation of man, Milton describes the Creator as ascending to his high abode and looking down upon the world to which, the angelic host sang, he would "send his winged messengers on errands of supernal grace."

> "He through Heaven
> That opened wide her blazing portals, led
> To God's eternal house direct the way—
> A broad and ample road, whose dust is gold,
> And pavement stars, as stars to thee appear
> Seen in the Galaxy, that milky way
> Which nightly as a circling zone thou seest
> Powdered with stars."

In Milton's time the Earth was believed to be the centre of the material universe, as had been taught by Ptolemy in the second century of our era and accepted in all theological and philosophical schools. Unlike Dante, he says nothing of the Earth itself.



From *Astronomical Myths.* JOHN F. BLAKE.

The Christian Cosmos as conceived by Fathers of the Church in the Middle Ages. The Earth is represented as a fixed disc at the centre of the universe and around it are the spheres of the Moon, the planets and the constellations of stars. The outermost sphere is that of the empyreal heaven, in which dwelt the cherubim and seraphim, with the Father sitting on a throne above them. In this picture, angels and saints of Christian theology share celestial spheres with heroes of classical mythology. Some of the constellations are misplaced and new names are given to others in the heavens of Jupiter and Saturn. The picture thus loosely combines theological beliefs with existing astronomical theory in its representation of the cosmos; and it belongs to the realm of religious art rather than that of science.

No other theory of the universe than that of Ptolemy was known to Shakespeare, who refers to "stars starting from their spheres", or had been taught to Milton; and none other was generally accepted, even by scientific people, until after Milton's death. He lived in a critical period of astronomical progress. The discoveries of Galileo and Kepler had shown the great probability of the truth of the Copernican system, but Newton had not yet established it as a gravitational consequence.

Hence, though Milton seems himself to have been unable to accept the Copernican system, he understood the complications involved in the Ptolemaic system. In *Paradise Lost* there are many passages, particularly in the discourse between Adam and the angel in the eighth book, which show that he saw and appreciated the simplicity and beauty of the Copernican theory. He represents Raphael as speaking with scarcely-veiled sarcasm of the celestial sphere being girded with "Centric and Eccentric scribbled o'er, Cycle and Epicycle orb in orb", and Adam's difficulty at conceiving "how nature, wise and frugal, could commit such disproportions".

Milton was, therefore, familiar with the Ptolemaic and the Copernican systems, and he refers to each in *Paradise Lost* without passing judgment upon either. In Book III we read, "They pass the planets seven, and passed the fixed and that crystalline sphere", this being the Ptolemaic view; while in Book VIII he presents the Copernican system very clearly in a conversation between the angel, Raphael and Adam. Raphael begins the conversation with the words:

> "To ask or search I blame thee not; for Heaven
> Is as the book of God before thee set,
> Wherein to read his wondrous works, and learn
> His seasons, hours, or days, or months, or years.
> This to attain, whether Heaven more or Earth
> Imports not, if thou reckon right."

Later, obviously referring to the Copernican system, Raphael says:

> "What if the Sun
> Be centre to the World, and other Stars
> By his attractive virtue and their own
> Incited, dance about him various rounds?
> Their wandering course, now high, now low, then hid,
> Progressive, retrograde, or standing still
> In six thou seest; and what if, seventh to these
> The planet Earth, so stedfast though she seem,
> Insensibly three different motions move."

The Ptolemaic and Copernican schemes are compared in a description of about 160 lines, but the question as to which should be accepted is left unanswered. Professor David Masson, however, in his scholarly introduction to Milton's poems [*The Poetical Works of John Milton.* (Globe Edition, London: Macmillan & Co., Ltd., 1934.)] describes the differences between the heliocentric and geocentric theories of the universe in relation to the treatment of cosmological conceptions generally presented in *Paradise Lost.* He acknowledges, of course, that Milton's astronomy was geocentric, and that the Mundane Universe was thought of as a definite succession of orbs revolving around the Earth, but referring to the conversation between Raphael and Adam already mentioned he says:

> "In this last passage Adam is represented as arriving by intuition at the Copernican theory, or at least perceiving its superior simplicity over the Ptolemaic; and though the drift of the angel's reply is that the question is an abstruse one, and that it is of no great consequence for man's real duty in the world which system is the true one, yet the balance of the angel's remarks is also Copernican. There is no doubt that these two passages were inserted by Milton to relieve his own mind on the subject, and by way of caution to the reader that the scheme of the physical Universe adopted in the construction of the poem is not to be taken as more than a hypothesis for the imagination."

It should be remembered that before the time of Milton all imaginative literature relating to man and his earthly abode was based upon the view that they were at the centre of the physical universe. The traditional belief of ages, that all objects in the universe were designed for the particular benefit of man, was enshrined in all literature, sacred and profane. It is remarkable, however, how soon the observations and conclusions of scientific pioneers like Copernicus, Galileo and Kepler became known in intellectual circles of their times and were introduced into imaginative literature.

IV

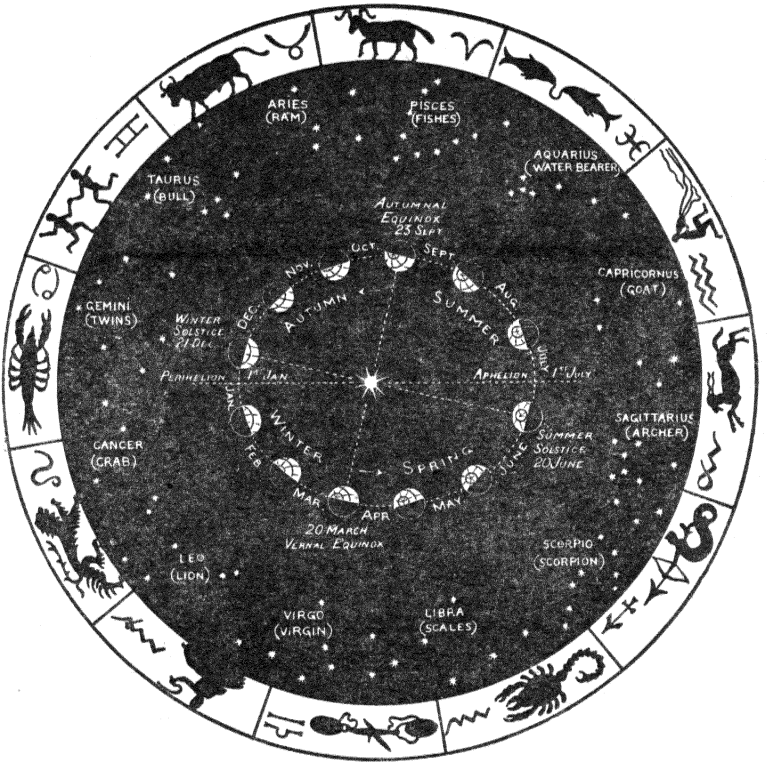
THE GIRDLE OF THE ZODIAC

THE celestial background upon which the Sun, Moon, and the planets Mercury, Venus, Mars, Jupiter and Saturn, and the rest, are projected, has an impressive and unchanging appearance from year to year. Bright stars, and distinctive configurations of them, have been recognized and named from the earliest times of which historical records exist and are known to-day to most primitive peoples. All these constellations on the blue canopy of heaven are twinkling points of light in groups which, by their distinctive outlines, mark them out as belonging to a higher and vaster system than that of the Sun's planetary family.

The Earth is a moving observatory from which celestial scenes are viewed. As it is a globe, one half only of the heavens can be seen from a single place at any one moment of time. As it also spins on its axis once in twenty-four hours, the daily courses of the stars and planets around it are reflections of this rotary motion. The centres of the majestic diurnal sweep of the starry sky are, therefore, the two geometrical points above the north and south ends of the Earth's axis.

Though the stars cannot be seen with the unaided human eye after the Sun has appeared above the horizon, because of the diffusion of sunlight by the Earth's atmosphere, different groups of stars were recorded in very early times as just above the eastern and western horizons at sunrise and sunset. In the course of a year, the Sun appears to make a circuit of the celestial sphere, and the groups of stars traversed by it form the zodiac. As the Sun is immovable in relation to the Earth, the annual circuit through the constellations of the zodiac is not its real movement but is an effect due to the revolution of the Earth around the Sun. The Sun's apparent path is called the ecliptic and is the projection of the plane of the Earth's orbit upon the heavens similar to the celestial equator, which is a circle on the stellar sky where the plane of the terrestrial equator meets the celestial sphere.

The constellations of the zodiac occupy a narrow belt along the celestial sphere, with the ecliptic as its central line. Within this zone the Sun, Moon and the planets are confined in their apparent movements. The zodiac is divided into twelve equal parts or signs through each of which the Sun passes in successive months. The



Constellations and signs of the Zodiac in relation to the earth's annual course around the Sun. The Zodiacal signs and constellations no longer coincide.

constellations of the zodiac are, however, not equally spaced around the belt, but they have the same order of succession and the same names.

A considerable amount of astronomical knowledge was possessed by the Sumerians—a race which occupied a region between the rivers Euphrates and Tigris about six thousand years ago. This land was the southern part of Mesopotamia, and the Sumerians appeared in it about 4500 B.C. The northern portion of Mesopotamia was the country of Akkad, or Babylon. Astronomical records in ancient cuneiform writing have been found which date from Sargon of Akkad, who lived about 2550 B.C., and from his successor, Naram

Sin; and in the time of Hammurabi (2550 B.C.) a formula for divination mentions the configuration of certain constellations.

It would, in fact, appear that by about 3000 B.C. the Sumerians were already well acquainted with the skies. They regarded the stars collectively as a flock of sheep, the Sun being the old sheep, while Sibzianna, which is thought to be Arcturus, was "the star of the shepherds of the heavenly herds". From boundary stones, inscribed cylinders and cuneiform tablets, many references have been collected which point to a considerable astronomical knowledge of this period. Groups of stars, or asterisms, were being formed with a well-defined system of star-names, and the zodiac was marked out. The constellation which we now know as that of the Virgin, for example, was recognized in the fourth millennium B.C. This knowledge was taken over from the Sumerians by the Babylonians.

A great store of astronomical and astrological lore was collected from older material in the library of Ashurbanipal about 650 B.C. This formed a library of reference; but there were also collected in the library the reports from an elaborate network of astronomical observations which were being made systematically all over the country.

It is in ancient Babylon that the earliest references to the signs of the zodiac are found. All the well-known zodiacal signs, except those of Cancer and Sagittarius, can be identified with figures represented upon engraved cylinder seals used to impress their designs upon tablets of the First Dynasty. In addition to groups of stars thus recognized, the Sun, Moon and planets were named and their positions used for astrological purposes. Their Babylonian names were: Shamash (the Sun); Sin (the Moon); Nabu (Mercury); Ishtar (Venus); Nergal (Mars); Marduk (Jupiter); and Ninurta (Saturn).

Just as researches on Mesopotamian texts in recent years have shown the existence of records of observations of the starry skies on the Euphrates as far back as the Sumerians, or earlier, so there is evidence that even before dynastic times in Egypt the appearance of the star Sirius near the Sun at sunrise was used to mark the beginning of a year. In the time of King Menes, the founder of the First Dynasty, about 3200 B.C., there was a college of priests, physicians, astronomers and astrologers at Heliopolis; and the three pyramids at Gizeh, built about 3000 B.C., were constructed with geometric accuracy based upon astronomical observations. In a tomb at the time of King Seti I (1320–1301 B.C.) appears a list of planets at their upper culmination, or highest points on the meridian; and this and other astronomical knowledge was afterwards passed on to the Greek and Roman worlds.



Star-map, including the constellations of the zodiac, from the temple at Dendera, Egypt. The relative positions of the figures representing separate groups of stars are much the same in all earlier and later maps, though the mythological characters differ in period and place.

In the Ramesseum at Thebes, the work of Rameses II, who lived about 1301–1234 B.C., are drawings and hieroglyphs representing twelve months, beginning with the month of Thoth, corresponding to parts of our present June and July. The months are arranged in relationship to certain constellations; and they show that the Egyptians were familiar with some of the constellations of the zodiac at the time of Rameses II, and probably long before. As the heliacal rising and setting of stars was recorded, it must have been observed that each month had a different group of stars near the Sun at sunrise and sunset. A group near the Sun at sunrise in any month would be above it at sunrise in the following month, and would not be with the Sun again until a year had passed. A particular group of stars, or constellation, is thus associated with each month, and twelve of such constellations make up the zodiac.

Several zodiacal constellations with others are represented by mythological figures on a so-called zodiac, which was originally on the ceiling of one of the chambers in the temple at Dendera and is now in the Bibliothèque Nationale in Paris. The figure of a jackal



Constellations of the Northern celestial hemisphere, with their figures derived from Greek mythology. The Configurations of star-groups are those described by Ptolemy in the second century A.D.; and the same names are still used to designate them.

in the centre represents what we now know as the Little Bear, one star of which is our Pole Star, though it was not the Pole Star at that time. Near it is a figure called the Thigh, represented by the leg of an animal and identified as the Great Bear. Other groups of stars represent the present constellations of the Dragon and Orion.

This zodiac, as well as two others at Esneh and Ed-Dayr, are of Ptolemaic and Roman construction, though no doubt they represent earlier conceptions. There is, however, clear evidence from both figures and inscriptions that observations of the stars were regularly made by the Egyptians and that names were given to certain constellations, some of which were associated with the rising of the Sun.

Observations of groups of stars seen just above the Sun at dawn or at twilight were associated with seasons and other events on the Earth in very early times. The groups were figures on a celestial dial, and the Sun took a year to pass round the complete circle of the heavens upon which they were fixed. The division of the circuit into twelve parts, or signs, which made up the zodiac, was recognized and used for religious and seasonal observances by the Chaldeans, the Chinese, the Egyptians, Hindus, Persians, Greeks, and other peoples. Each of the twelve signs of the zodiac represented a "house" of the Sun for a particular month; and at the end of a year the Sun would be seen in the same sign. This solar zodiac was made the principal foundation of the astronomies of Egypt and Greece—and through them of the western astronomical systems—and, with its symbols, their respective systems of mythology were associated.

In the more eastern countries, however, and especially in India, in the earliest times of which we have knowledge, although the solar zodiac was known, the progress of the Moon through different groups of stars in the course of a month was also observed and used as a measure of time. This lunar circuit was divided into twenty-eight parts called lunar mansions or stations, each division corresponding nearly with the space of the Moon's daily motion as marked by bright stars or groups of stars along the circuit.

At a later period Hindu astronomers reduced the number of divisions from twenty-eight to twenty-seven, which is a closer approximation to the length of the sidereal month, and makes the "asterisms" agree more nearly with the Moon's daily motion. They did not make a catalogue of stars, but confined their attention to stars which lie in or near the Moon's path and are liable to be obscured by the Moon or be in occasional conjunction with the planets. Lists of such stars, or asterisms, are given in several ancient Hindu works on astronomy, and are recorded in Sanskrit literature. [See *Hindu Astronomy*. By W. Brennand. (London: Chas. Straker & Sons, Ltd., 1896.)]

The Arabs, also, from early times possessed a scheme of "lunar mansions", in which the constellations were arranged in groups corresponding to the positions of the Moon in them, therefore forming a lunar zodiac, as was also recognized in Mesopotamia.

The unequal distribution of stars along either the Sun's or the Moon's path in the heavens led astronomers in early times to divide the path into equal parts, each of which was a sign of the zodiac. There seems first to have been six of such signs, and then twelve, in the year. Each sign represented a month of thirty days, and one-third of a sign corresponded, therefore, to a week of ten days, as

used in Egypt and in Greece. The signs began at the spring equinox, when day and night are equal in length; and, when the present order of the signs was adopted, the Sun at that time of year must have been near the constellation of Aries—the Ram.

On account of a secular change in the direction of the Earth's axis, the positions of stars in relation to that of the Sun at the time of an equinox vary in a cycle of about twenty-six thousand years, known as the "precession of the equinoxes". The result is that the constellations of the zodiac move backward in this period through the signs of the zodiac; consequently, the star-group in which the Sun is at the spring equinox is not now the Ram but the Fishes. At an earlier period the Bull or Ox was the leader of the zodiacal figures, and before that epoch—about 4500 B.C.—the Sun was in the constellation of the Twins at the time of the spring equinox.

The annual circuit of the Sun in the heavens, and the established places and orderly appearances of the starry host at night and at different seasons, inspired many beautiful passages in the Bible. They are not, however, conceived as subjects of worship, but are regarded as revelations of the majesty of their Divine Creator. Thus, in the nineteenth Psalm, we read:

> "The heavens declare the glory of God; and the firmament sheweth his handiwork.
>
> "Day unto day uttereth speech, and night unto night sheweth knowledge.
>
> "In them hath he set a tabernacle for the sun, which is as a bridegroom coming out of his chamber, and rejoiceth as a strong man to run a race.
>
> "His going forth is from the end of the heaven, and his circuit unto the ends of it: and there is nothing hid from the heat thereof."

The relation of the constellations (and in particular those on or near the zodiac) to the seasons seems to be the interpretation of the words of Job (Chap. xxviii):

> "Canst thou bind the sweet influences of Pleiades, or loose the bands of Orion? Canst thou bring forth Mazzaroth in his season? or canst thou guide Arcturus with his sons?"

There has been much discussion as to the meaning of the word Mazzaroth; but, from an astronomical point of view, the most reasonable is that it signifies the divisions of the year, or the twelve signs of the zodiac, and corresponds to the word "mizrata" in the line of the Babylonian tablet of creation:

"He ordained the year, and into sections (mizrata) he divided it."

Job's question would thus mean:

"Canst thou so move the great celestial sphere that the varied constellations of the zodiac shall come into view, each in their turn, and with them the earth pass through its proper successive seasons?" [*The Astronomy of the Bible.* By E. W. Maunder. (London, 1908.)]

The rising of the Pleiades with the Sun in the spring suggests that Job's question relating to this group of stars signified:

"Canst thou prevent the revival of all the forces of Nature in the springtime?"

and similarly, with regard to Orion, which is a winter constellation:

"Canst thou free the ground from the numbing frosts of winter?"

As the twelve constellations of the zodiac were known a thousand years or more before the days of Joseph, the astronomical interpretation of his second dream is clear.

"Behold," he said, "I have dreamed a dream more: and, behold, the sun and the moon and the eleven stars made obeisance to me."

The Sun signified his father; the Moon, his mother; and the eleven stars or constellations, his eleven brethren: hence the rebuke of Jacob:

"What is this dream that thou hast dreamed? Shall I and thy mother and thy brethren indeed come to bow down ourselves to thee to the earth?"

There is a certain amount of evidence to associate the twelve tribes of Israel with constellations of the zodiac, and the designations or descriptions given to each son in the blessing of Jacob affords support to this view. However this may be, the connection of the four chief tribes with the zodiac is shown by Jacob's references to Judah as "a lion's whelp": Reuben, "unstable as water"

Dan, "a serpent by the way"; and the association of Joseph with an ox or bull in the blessing of the tribes of Israel by Moses in the words: "His glory is like the firstling of his bullock."

Moreover, the traditional devices upon the sacred standards of these tribes—for Judah, a lion; for Reuben, a man and a river; for Ephraim, a bull; and for Dan, an eagle or serpent, all of which are identified with constellations of the zodiac—indicate an undoubted connection between them. These tribes always pitched their tents around the tabernacle in the four corners of the camp, representing the four quarters of the heavens.

In an earlier chapter it has been shown how the various celestial phenomena and events are due to particular movements of the Sun, Moon and planets in relation to the stars. As the retrograde movement of the spring equinox, or the "precession of the equinoxes", has to be taken into account in connection with the movement of the signs of the zodiac and the construction of the calendar, it may be worth while to explain briefly what this signifies. For this purpose, the celestial vault may be regarded as a sphere upon which the stars are fixed, even though we know that every star is in movement and that they are at immensely different distances from the Earth.

Upon such an imaginary sphere, the celestial poles are the two mathematical points in the heavens exactly above the poles of the Earth. They are the points where the Earth's axis of rotation, if imagined to be extended in each direction, would touch the sky. Theoretically, at a point on the Earth exactly at the north or the south pole, there would be no rotation; and this applies also to the poles of the heavens. On account of the rotation of the Earth on its axis once a day, the stars appear to describe circles around the celestial poles. The centre of such circles of apparent movements seen in the northern hemisphere of the Earth is the north celestial pole; and that of similar diurnal movements, seen in the southern hemisphere, is the south celestial pole.

It happens at various epochs that a bright star is near one or other of the two celestial poles; and such a star is then called the Pole Star. The North Star, seen in the northern hemisphere on any fine night, is not exactly at the north celestial pole, but describes a circle around it at a distance approximately equal to the apparent diameter of the full moon. The width of an ordinary cedar-wood lead pencil held upright at arm's length roughly represents the apparent separation of the North Star from the north pole of the heavens. For practical purposes, however, the North Star may be regarded as being at the north celestial pole, and therefore as being at a fixed point. This is the sense in which Shakespeare makes Julius Cæsar say:

"I am constant as the northern star,
Of whose true-fix'd and resting quality
There is no fellow in the firmament.
The skies are painted with unnumber'd sparks,
They are all fire and every one doth shine,
But there's but one in all doth hold his place."

Just as the poles of the heavens are exactly above the poles of the Earth, so the celestial equator is the great circle in the sky corresponding to the Earth's equator. Any star exactly overhead to an observer at the Earth's equator is therefore on the celestial equator. If a luminous circle be imagined, drawn upon the sky to mark the position of the celestial equator, the Sun would be seen to cross this line from the south to the north side on March 21. The part of the sky behind the Sun on that day is occupied by the sign of the zodiac known as Aries, or the Ram: and the exact point at which the Sun crosses the equator is known as the First Point of Aries, or the vernal equinox. The group of stars, or constellation, now behind that point on March 21 is, however, not that of the Ram, but of the Fishes.

On account of this slow westward or retrograde movement, due to the precession of the equinoxes, the length of the seasonal year differs from that determined by observations of stars near the Sun at sunrise or sunset. The difference had been noticed long before the Greek astronomer Hipparchus (in the second century before the Christian era) used observations of Babylonian astronomers to assign a value to it. Expressed in time, this value amounts to about twenty minutes a year, and carries the spring equinox completely around the sky in about twenty-six thousand years.

Whatever position the "First Point of Aries" occupies in relation to the stars, the signs of the zodiac are twelve equal divisions of the circuit of the sky, beginning with it. The *signs* of the zodiac, therefore, move around the sky on account of precession, but the *constellations* of the zodiac, which are irregular groups of stars in the sky, maintain their positions unaltered.

Astrologers construct their horoscopes from the positions of planets in the zodiac at the time of birth, and claim that these determine the temperament and mental and physical health of people, as well as prospects of success or failure in future activities or interests in life. The signs of the zodiac are purely geometrical divisions of the Sun's apparent annual circuit of the sky, caused by the revolution of the Earth around it. This was divided into twelve parts as a convenient measure of time, each representing a month, but these parts, or "houses" of the astrologers, are distinct from the

background of stars and have no established cosmic significance.

Astrology is a science which belongs to the period of human history when the Earth was believed to be a flat plane with the ceiling of heaven above it. In this canopy the planets and other celestial bodies were carried along their courses by particular gods or angels having direct influences upon individuals or communities. As an element in the history of civilization this variety show is of interest; but as a factor determining human character or action it is based upon tradition rather than upon scientific evidence.

V

THE APOTHEOSIS OF ASTRONOMY

Just as the twelve constellations of the zodiac appear in succession near the Sun at sunrise and sunset during each year, so other constellations above and below this belt of the celestial sphere appear on the eastern horizon and set on the western in the different months. Every fine night, when facing north in the northern hemisphere, other constellations are seen to be circling around the north pole of the heavens, and their number depends upon the latitude from which the sky is viewed. The Pole Star is close to this point, the angular distance of which above the northern horizon is nearly the same as that of the latitude of the place of observation. The extent or the circle of circum-polar constellations visible throughout the year increases, therefore, in travelling northward on the Earth. The constellations seen outside this circle when facing south differ during the year in the same orderly succession as those of the zodiac, each appearing in a particular season and observable at night-time.

The most prominent configuration of this kind, to be seen when looking south in the winter months of the northern hemisphere, is that of Orion. Three bright stars in a line are surrounded by four other stars at the corners of a large oblong. The three stars form the glittering belt of Orion, the mighty hunter, and the two above it are on the right and left shoulders of his legendary figure, while the two below mark his lower limbs. The line of the belt points downward to the brightest gem of the sky, the Dog-Star, Sirius, and upward to a compact triangular cluster of stars called the Pleiades,

six or seven of which can be distinguished with unaided eyes. The group is in a shoulder of the constellation of Taurus, the Bull, and is visible from places in both the southern and northern hemispheres of the Earth.

The cluster of the Pleiades has been used by many peoples to divide the year into two seasons, by the times of its rising in the morning and setting in the evening. In September it first becomes visible low down on the eastern horizon, and in March it can be seen setting in the west. In November it reaches its highest point, or culmination, at midnight. It heralds by one hour the rising of the constellation of Taurus, which was once occupied by the Sun at the vernal equinox and the beginning of the spring season in the northern hemisphere. In the southern hemisphere, however, in the time of sowing (which is what the word season signifies) conditions are reversed and September takes the place of March in agricultural operations.

The aboriginal natives of Central Australia still celebrate the beginning of a New Year with the culmination of the Pleiades at midnight, though on account of the precession of the equinoxes this no longer corresponds with the opening of their spring. Other peoples south of the equator begin their New Years with the first appearance of the Pleiades at sunset and celebrate it with festivals of the dead, and in some places with offerings of first-fruits. In medieval times and later, the corresponding date of the beginning of the New Year in Christian Europe was March 25, or Lady Day, when the festival of the "Annunciation" is celebrated.

Although among the cave paintings and engravings, which prehistoric man has left to us in evidence of his magical and religious beliefs, there is none upon which an astronomical interpretation could be placed with certainty, it is clear that with the introduction of agriculture in Neolithic times man must have looked to the heavens for guidance in his calendar of operations among his flocks and herds and in his fields.

It may be that in early times the constellations were of even greater significance than the Sun and Moon, just as they are now among the primitive peoples of modern times, for whom in many parts of the world the rising of the Pleiades marks the beginning of the year and the time to prepare the ground for planting. Nearly everywhere in the Polynesian Islands the New Year begins, in December, with the first New Moon after the first appearance of the Pleiades in the eastern sky in the evening twilight. Also, while the Kenyah and Kayan of Borneo note the passing of time by measuring the Sun's shadow with a marked stick, they nevertheless send a man to the forest to watch for the rising of the Pleiades to warn them of the coming of the north-west monsoon.



Photo, *YERKES OBSERVATORY.*

The Great Nebula in the Constellation of Andromeda—a concourse of stars and star-mist visible to the naked eye, though so far away that light from it takes nearly a million years to reach our part of the universe. Several millions of stellar systems of this kind are known to exist, each containing thousands of millions of stars at vast differences from one another. The Sun is a single star of average size in a similar lens-like structure of which our Galaxy, or Milky Way, marks the direction of the longest axis and the girdle of our "island universe". (*See Chapter One.*)

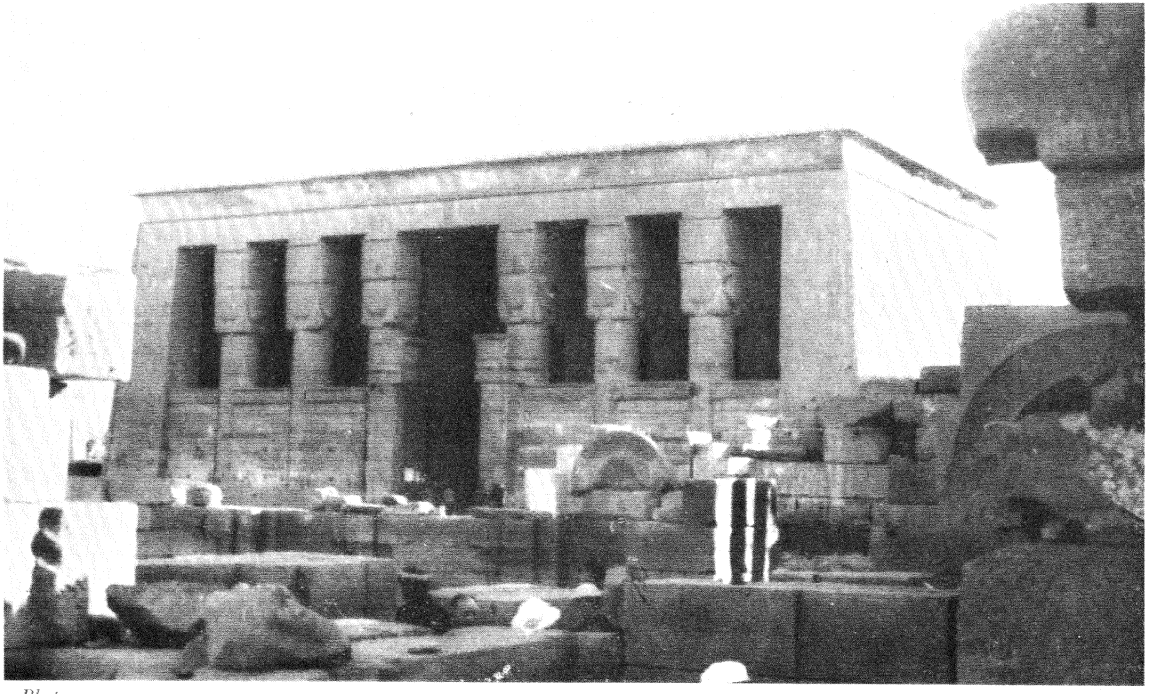


Photo. *E. N. S.*

GREAT TEMPLE AT DENDERA, Upper Egypt, the principal seat of the worship of Hathor, sky-goddess of love and joy, corresponding to Aphrodite of the Greeks and the Latin Venus. The temple faces the north-east: and an inscription in it states that, at the date of its foundation, the star Sirius (Sothis of the Greeks) rose with the Sun on the Egyptian New Year's Day, the 20th of June. The present Greco-Roman structure was built in the 1st century B.C. *(See Chapter VI.)*

said to have been sent by Zeus as portents for mariners. Homer mentions only one planet, Venus, which he seemed to regard as two separate objects as the "Morning" and "Evening" stars.

From the sixth century B.C. onward there are frequent references in the poets and other writers to legends connected with the stars. Among earlier writers are Epimenides, the Cretan, who referred to the constellation Capricornus and also to the star Capella; Pherecydes of Syros (500–450 B.C.) recorded the legend of Orion and stated the astronomical fact that, when Orion sets, Scorpio rises. Aeschylus and the Greek historian Hellanicus (fifth century B.C.) narrate the legend of the Pleiades, while a weather calendar mentions Aquarius, Aquila, Canis major, Corona, Cygnus, Hyades, Pleiades and other groups of stars.

The earliest Greek work on astronomy is that of Eudoxus of Cnidus (403–350 B.C.) transmitted in verse by Aratus (about 270 B.C.), who enumerates forty-four constellations. A commentary upon their works was written by Hipparchus, who was as great an astronomer as Aratus was a poet. Ptolemy (A.D. 100–178), who was the definitive authority on astronomy of the ancient world, enumerates forty-eight constellations. These constellations, with few changes, are still used by astronomers to mark the grouping of stars in the sky.

In his *Works and Days*, which dates from about 800 B.C., Hesiod has many references to the constellations. The following are of interest:

> "When the Pleiades, daughters of Atlas, are rising, begin your harvest, and your ploughing when they are going to set. Forty days and nights they are hidden and appear again as the year moves round, when first you sharpen your sickle".
>
> "When the piercing power and sultry heat of the sun abate, and almighty Zeus sends the autumn rains, and men's flesh comes to feel far easier—for then the star Sirius passes over the heads of men, who are born to misery, only a little while by day and takes a greater share of night—then, when it showers its leaves to the ground and stops sprouting, the wood which you cut with your axe is least liable to worm. Then remember to hew your timber".
>
> " . . . on a winter's day when the Boneless One [the octopus] gnaws his foot in his fireless house and wretched home; for the sun shows him no pastures to make for, but goes to and fro over the land and city of dusky men [the Egyptians or Ethiopians] and shines more sluggishly upon the whole race of the Hellenes".

"When Zeus has finished sixty wintry days after the solstice, then the star Arcturus leaves the holy stream of Ocean and first rises brilliant at dusk. After him the shrilly wailing daughter of Pandion, the swallow, appears to men when spring is just beginning. Before she comes, prune the vines, for it is best so".

"But when the House-Carrier [the snail] climbs up the plants from the earth to escape the Pleiades, then it is no longer the season for digging vineyards, but to whet your sickles and rouse up your slaves".

"But when the artichoke flowers and the chirping grasshopper sits in a tree and pours down his shrill song continually from under his wings in the season of wearisome heat, then goats are plumpest and wine sweetest; women are most wanton, but men are feeblest, because Sirius parches head and knees and the skin is dry through heat".

"Set your slaves to winnow Demeter's holy grain, when strong Orion first appears, on a smooth threshing floor in an airy place".

"But when Orion and Sirius are come into mid-heaven, and rosy-fingered Dawn sees Arcturus, then cut off all grape-clusters, Perses, and bring them home. . . . But when the Pleiades and Hyades and strong Orion begin to set, then remember to plough in season; and so the completed year will fitly pass beneath the earth".

"But if desire for uncomfortable sea-faring seize you; when the Pleiades plunge into the misty sea to escape Orion's rude strength, then truly gales of all kinds rage".

"Fifty days after the solstice, when the season of wearisome heat is come to an end, is the right time for men to go sailing. Then you will not wreck your ship, nor will the sea destroy the sailors, unless Poseidon, the Earth-Shaker, be set upon it, or Zeus, the king of the deathless gods, wish to slay them". [Translated by Hugh G. Evelyn-White. (London: William Heinemann, 1914.)]

The most renowned Greek poem on astronomy is the *Phenomena* of Aratus, who obtained his knowledge of the subject from Eudoxus of Cnidus, and of weather portents and signs, described in another poem, *Diosemeia*, from Theophrastus. His astronomical poem was for several centuries very popular among the Athenians, who regarded it as comparable to Homer's *Iliad*. He was esteemed by both Christian and pagan philosophers.

Aratus described twenty constellations north of the celestial equator, the twelve constellations along the zodiac, and twelve south of the celestial equator, making forty-four in all. The poem is

purely a didactic picture of the division of the heavens into regions represented in stories of Greek mythology, yet for half a dozen centuries its influence upon writers who followed Aratus was immense.

The use of the constellation of the Great Bear (Helice) by Greek mariners and of the Little Bear (Cynosyra or Cynosure) by Phoenicians is referred to in the lines:

"Pleasing to sight is Helice's bright team,
And Grecian sailors hail her guiding beam.
When toss'd by adverse winds and tempest black
Mid wintry seas their dubious course they track.
But hardier sons of Tyre, who love to brave
The unknown monsters of th'Atlantic wave,
By Cynosyra's surer guidance steer
And safe return to wife and children dear".

[*The Phenomena and Diosemeia of Aratus*, translated into English verse, with notes, by John Lamb. (London: John W. Parker, 1848.)]

The astronomical poem of Aratus describes the constellations, the planets, the zodiac and the Sun's course through it, and the positions of the chief circles on the celestial sphere—the Tropic of Cancer and Capricorn and the celestial equator. The description of Hephaestus's shield in Homer's *Iliad* refers to these objects and movements in the words:

"There shone the image of the master mind;
There earth, there heaven, there ocean he design'd;
The unwearied Sun, the Moon completely round:
The starry lights that heaven's high convex crown'd;
The Pleiads, Hyads, with the northern team;
And great Orion's more refulgent beam
To which around the axle of the sky
The Bear revolving points his golden eye;
Still shines exalted in the ethereal plain,
Nor bathes his blazing forehead in the main".

[Alexander Pope's translation of the *Iliad.* (1715–1720.)]

Aratus could scarcely be called an astronomer, but what he did was to bring together in a remarkable poem the traditional knowledge of the constellations and certain stars in them. The heavens described by Aratus did not actually represent conditions in his time, but about a couple of thousand years earlier. The star-list of Hipparchus and Ptolemy agrees with that of Aratus with a few

exceptions. Hipparchus, "who had ventured to count the stars, a work arduous even for the Deity" (Pliny, His. Nat., ii, 26), made a catalogue of 1680 stars. Ptolemy's catalogue included 1022 stars, of which 914 form constellation figures. He placed two additional constellations among the unformed stars, while recognizing the ancient groups. The constellations of the Greeks were adopted by the Romans and other peoples, and are still used to designate divisions of the celestial sphere.

From whatever source the Greeks derived their knowledge of the heavens and particular groupings of stars upon them, the actual origin of the association of constellation figures with characters in Greek mythology has been the subject of much discussion. As several of the constellations represent characters in the voyage of the Argonauts, and none is named after the heroes of Troy, the grouping must have been settled after the expedition of the Argonauts and before the destruction of Troy.

Whatever the origin of the names, all the characters in a particular drama or legend are represented together in the heavens. Thus one group of constellations consists of Cepheus and his wife Cassiopeia, with Andromeda, their daughter, waiting to be devoured by Cetus, but rescued by Perseus, who was flying through the air after slaying the Gorgon, and who turned the sea-monster into stone by showing it the head of Medusa.

The apotheosis of all these figures is easy to understand, if the myth was the origin of the constellations bearing names imposed upon them by imaginative characters; but the history of many such star-groups goes back much beyond Greek times, and it is closely connected with astronomical relationships. From this point of view the story of Hercules, which was derived from a group of cosmic myths going back to very remote times in Mesopotamia and Western Asia, originated in the sky; the giant was a solar hero, and his twelve labours represented the Sun's course along the zodiac, quenching the starlight of the twelve signs one after another, and renewing every year his round of labours.

Cicero and other writers translated Aratus's poems into Latin, and several Roman poets, including Virgil (70–19 B.C.), quoted largely from them. In his great didactic poem, the *Georgics*, Virgil, with stimulative imagination, brings man into intimate contact with Nature.

Agriculture and its relation to the seasons and deities associated with them is the theme of the first book of this poem. To know the proper times of sowing and other operations on the land, the stars must be watched as closely by the farmer as by the navigator. At the autumnal equinox, when days and nights are equal in length,

the Sun is in the constellation of the Balance. The constellation of the Scorpion was regarded at one time as occupying two-twelfths of the zodiac, but later the Balance was introduced between the Scorpion and the Virgin. When the Sun enters the constellation of the Bull on April 17, certain seeds may be sown, but the sowing of some other seeds should be postponed until the setting of Maia (one of the Pleiades) and of Bootes in November. The movement of the Sun through the twelve signs of the zodiac guides the husbandman in his annual tasks. The changes of the seasons are thus connected with celestial signs and reveal orderly design and purpose.

Virgil's five zones of the sky and the Earth are derived from a work by Eratosthenes (276—196 B.C.), and the description is not altogether clear. The Earth is regarded as flat, with the celestial sphere revolving around it on an axis, one end of which rises toward the north (Scythia), while the other pole is in the gloomy Styx of the underworld. Arctos, the constellation of the Bear, or, in plural, the Great and Little Bears, is so close to the pole that, unlike some other groups of stars, it does not sink into the ocean which surrounds the world. Virgil's story of these relationships between Earth and sky has been beautifully rendered into English:

"We yeomen, moreover, must watch Arcturus' star, and the rise
Of the Kids, and the gleaming Serpent, with no less heedful eyes
Than do they who over the wind-scourged waters home-ward bound
On Pontus venture their lives, and Abydos' oyster-ground.
When the hours of day and of slumber the Balance hath equal made,
And now hath parted the world in twain, 'twixt light and shade,
Goad, yeomen, your steers to their toil, wide sow with barley the plain
To the very verge of baffling winter's stormy rain.
Then, too, is the time when the flax and the poppy of Ceres should lie
Earth-veiled, and ere then, while thou canst, while yet the ground is dry,
Bend over the plough, while the clouds burst not, but still hang high,
For beans is the sowing-time spring; then, child of the East, lucerne,
Soft furrows receive thee, and care for the millet must yearly return
When gleaming-white the Bull with his golden horns, thrusts wide

The gates of the year, and the Dogstar backward sinks in the tide.
But if for a harvest of wheat and of sturdy spelt thou wilt till
The ground, and on naught but the golden ears hast fixed thy will,
Let the morning setting of Atlas' Daughters be seen of thee,
And the eventide plunge of the stars of the flaming Crown in the sea,
Or ever thou yield to the furrows their debt of seed, and ere
Thou haste to entrust to the grudging earth the hope of the year.
Many before the setting of Maia begin, but they
See their dreams of a harvest vanish in empty ears away.
But and if it be vetch thou wilt sow, and the bean of little price,
And the care of the Nile-born lentil be not contemned in thine eyes,
Bootes' setting will flash unto thee no doubtful token:
Begin, and till frost's mid-season thy sowing may stretch unbroken.
For our guidance the sun directeth his golden car's career
In portions fixed, measures out through the twelve great Signs of the sphere.
Five Zones span all the heaven, whereof one flusheth aye
Red in the flame of the sun, and is scorched by his fire alway;
And around this far to the right and far to the left sweep twain
Stiff-frozen with pale-blue ice, and dark with stormy rain.
'Twixt these and the midmost are twain bestowed by the bounty of Heaven
On afflicted mortals, and through them a highway celestial is driven
Where slantwise wheels the procession of Signs for seasons given.
High as the world towers up toward norland hills of snow,
So low doth it slope and sink toward Libya's torrid glow
This pole hangeth over our heads evermore: that other, 'tis told,
Dark Styx and the netherworld Ghosts far under their feet behold.
With sinuous coiling here doth the giant Serpent glide,
And around and between the Bears in river-fashion slide—
The Bears that fearfully shrink from plunging in Ocean's tide."

[*The Georgics of Virgil in English Verse*, by Dr. Arthur S. Way. (London: Macmillan & Co., Ltd., 1912.) Georgic I, lines 204–246.]

Nature-poetry is at its best when direct observation of natural objects or events inspires creative ideas concerning them. The heavens have always been a favourite theme because of their

mystery and their association with conceptions of divinity. Faithful description of celestial scenes, when combined with imaginative insight, reflects scientific truth as well as emotional response to what is seen. The purpose of poetry is not to unveil mystery, but to express it in imagery, yet knowledge obtained by observation has inspired some of the greatest poets and provided them with their wealth of allusion.

VI

CALENDARS AND FESTIVALS

At all parts of the Earth the year is divided into seasons which mark different conditions of weather, such as rainy and dry, stormy and calm, or hot and cold. In many regions the seasons are determined by monsoon winds, which blow from the south-west in summer and are wet or rainy, and in winter are dry winds from the north-east. Near the equator, where day and night remain equal in length through the year, there are thus only two seasons, and the opening of one or both is heralded by the appearance of particular groups of stars at sunrise or sunset. In other latitudes, the number of hours during which the Sun is above the horizon increases from winter to summer and is equal only on particular days in spring and autumn, when the Sun is on the celestial equator.

This occurs at the equinoxes—in the spring on March 21 and in the autumn on September 23. At places between latitudes $23\frac{1}{2}$ degrees north and $23\frac{1}{2}$ degrees south of the equator the Sun is directly overhead at noon twice in every year. This is the torrid zone, and its northern limit is the Tropic of Cancer, while the southern is the Tropic of Capricorn, in both celestial and terrestrial latitudes. In the northern hemisphere the Sun reaches its highest noonday position, and its most northerly point on the horizon at rising, on June 21, and its lowest and most southerly point on December 22. These dates mark the turning points or solstices of the Sun's apparent annual course in the sky, and the longest and shortest days respectively. In the southern hemisphere summer and winter periods are the reverse of those in the northern, the longest day, or solstice, being on December 22, and the shortest on June 21.

When birds and other creatures migrate from one region to another they do so to find new feeding grounds at different periods

or seasons of the year. Nomadic races move from place to place in the same way to find pasture for their herds of cattle. The seasons of peoples who depend upon the fruits of the Earth for their food supply are determined by periods of sowing, ripening and harvesting, which begin in the spring and end in the autumn.

Primitive races regulate their lives by this cycle of seasonal changes without measuring the noonday altitudes at the summer and winter solstices and the equinoxes or the true length of their operational year. By measurements of the length of the noonday shadow of a fixed pillar, or Gnomon, the ancient Egyptians, Babylonians and Chinese were able to determine the dates when the Sun reached its highest and lowest points—the solstices. From such observations the greatest angular distance north and south of the equator was calculated. This angle between the celestial equator and the circle of the Sun's course is known as the "obliquity of the ecliptic", and it amounts to $23\frac{1}{2}$ degrees.

As the cycle of the seasons depends upon the distance of the noonday Sun north or south of the equator, the dates of the solstices and the equinoxes between them divide this solar year into four parts corresponding to spring, summer, autumn and winter. Many peoples have begun their calendar years at the spring equinox, which becomes their New Year's Day. In the earliest systems of time-reckoning the Moon is the basis instead of the Sun, and the calendar consists of twelve lunar months, each beginning close to the day of the New Moon.

The division of the year into months independently of seasonal conditions is more ancient than the solar year, because the most obvious period of time derived from astronomical observations is that between the successive appearances of phases of the Moon. The interval between two crescent Moons seen in the west, or of two Full Moons, has usually been counted as thirty days, but as the actual length of the interval is $29\frac{1}{2}$ days, the month of the solar calendar is not in gear with the lunar month.

The division of the year into twelve months of thirty days each was adopted in ancient Egypt at a very early date, but later the true length of the solar year was determined and the lunar period adjusted to it. The original basis of the beginning of each year was the rising of the River Nile, which was found by the Egyptian astronomer-priests to be heralded by the appearance of the star Sirius just before the rising of the Sun.

The star Sirius or Sothis is the brightest in the sky, and it was observed by early Egyptians to appear above the eastern horizon just before the rising of the Sun each year on July 19 or 20 (June 19 or 20 of our calendar) which was very near the time of the

annual inundation of the Nile. The visibility of the star at the time of sunrise is referred to in an inscription in a temple at Dendera, one of the best-preserved temples in Egypt. The building is not very ancient, being of Greek and Roman origin, though constructed on earlier foundations. The large temple on the site was dedicated to the goddess Hathor, whom the Greeks identified with Aphrodite; and it opens to the north-east. The small temple of Isis, which forms part of the main building, points south-east and was devoted to the celebration of the festival of the New Year, marked by the appearance of the Star Sirius. An inscription in this temple referring to Sirius reads:

> "She shines into her temple on New Year's Day, and she mingles her light with that of her father Ra on the horizon".

About 700 B.C. the star Sirius rose with the Sun on the Egyptian New Year's Day, and the light of both was mingled in the sky. The Egyptian year was derived from observations of these heliacal risings of the star Sirius. The rising of the star heralded the rising of the Sun, and the interval was used by the priests to prepare for the solemn ceremonial which took place on New Year's morning, or the great festival of the Nile rising near the summer solstice.

The primitive year of the Egyptians appears to have been one of 360 days. The months in such a year—apparently based upon the lunar month—would not, however, correspond to the succession of the seasons of a solar year, and before 3000 B.C. a year of 365 days was adopted as the civil or "vague" year; but as this year was shorter than the natural year by one quarter of a day, or about a day in four years, the dates of seasons would work backward in time through all the months of the year.

Continued observations of the Sun at the summer solstice soon revealed that the established year of 365 days was not a natural or solar year; consequently the sacrifices and feasts, which were regulated by it, did not fall in the seasons with which they were made originally to correspond. When, however, the priests had discovered that the more accurate length of the natural year was 365¼ days, they did not introduce an extra day every four years to adjust the difference, but maintained the length of 365 days as that of the civil year and imposed an oath upon their kings not to alter it. Only the priests were thus able to know when the true year began and the inundation of the Nile could be expected.

The difference between the lengths of the civil and sacred years suggested to the Egyptians that 1460 solar or natural years of 365¼ days would correspond in length to 1461 civil or calendar years of

365 days, and this relationship is their famous Sothic or Dog-Star cycle. A day in this cycle corresponds to four years in actual time. Calculations show that the heliacal rising of Sirius took place on July 21 in 1317 B.C. and 2773 B.C. For several centuries before this date the Egyptian New Year began with the appearance of that star, and each such appearance began a new cycle.

The year of the Egyptians was divided from early times into three seasons, each of four months, beginning with the month of Thoth, the god of wisdom, at the end of June. There were four months of inundation, four of seed-time and four of harvest, corresponding to winter, spring and summer; and each month was divided into thirty days. The whole calendar is depicted on a frieze in a hall of the great temple at Dendera.

The months are often given names from the principal agricultural operations going on when the Moon appears and while it lasts, independently of the length of the solar year. At an early stage of civilization a certain number of lunations is thus adopted as a cycle, and this may not extend to the whole natural year. Not until systematic astronomical observations had been made and recorded did the question arise as to the number of lunar months in a solar year.

In Babylonia, the year was of twelve months and New Year's Day when the crescent Moon was first seen in the autumn. The Egyptian year also contained twelve months of thirty days derived from the length of a lunation. The ancient Hebrew calendar was of the normal lunar type with twelve months, each of which began with the first visibility of the crescent Moon.

The year of the Hebrew Calendar—*Anno Mundi*—begins with the creation of the world, which is deduced from events recorded in the book of Genesis. This date is taken as October 7, 3761 B.C., which, added to the year of the Christian era, gives the number of the Jewish year. Thus the year 1948 was in the Jewish Calendar 3761 plus 1948, or 5709, with the Fast of the New Year celebrated on October 4 in the Jewish month of Tishri. The calendar has the lunar cycle of nineteen years as its basis, and the dates of the Passover and other fasts and festivals follow the same cycle.

The time of New Moon as given in a modern calendar is that of the instant when the Moon is in the same direction as the Sun. When the Moon is directly between the Earth and the Sun there is an eclipse of the Sun, but usually the Moon is north or south of the Sun, and not exactly in the same line. The month of the Babylonians and other early peoples did not begin at the time of astronomical New Moon, but when the thin sickle was first seen about a day later. The shortest possible interval between the true time of

New Moon and that at which the crescent becomes visible in the evening sky is twenty-three hours, but it obviously depends upon the state of the sky and the position of the observer on the Earth.

The Athenians began their year with the first New Moon after the summer solstice, and this year was divided into twelve months, containing alternately thirty and twenty-nine days. Each month was again divided into three weeks of ten days each. The Romans also divided their months into three parts, and the first day of any month was called Calends, meaning "to call out", because proclamation was then made to the people that it was the day of New Moon.

The original Roman calendar is believed to have been one of 304 days, divided into ten months beginning with March. According to tradition, Numa Pompilius, the second legendary king of Rome, introduced a lunar year and added the months January and February. The twelve lunar months were named Martius, Aprilis, Maius, Junius, Quintilis (afterwards called Julius), Sextilis (afterwards named Augustus), September, October, November, December, Januarius, Februarius.

At the time of Julius Cæsar, various calendars were in use, many of them purely local, with the result that there was no standardized relation between the months of the year and the seasons. With the assistance of the astronomer Sosigenes of Alexandria, Cæsar constructed a revised calendar based upon the knowledge derived from the Egyptians that the mean length of the solar year is 365¼ days. The additional quarter of a day was allowed for in the calendar by making every fourth year contain 366 days instead of 365. Cæsar decreed that the new calendar should come into force in the year 45 B.C. on January 1, being the day of the New Moon immediately following the winter solstice of the year before. The calendar had become so greatly disordered at that time that to introduce the new system it was necessary to enact that the year 36 B.C. should consist of 445 days, which led to its being described as "the year of confusion".

The Roman or Julian calendar remained in force throughout most of the civilized world until it was reformed by Pope Gregory in A.D. 1582. As the true length of the season year is not 365 days 6 hours, as used by Julius Cæsar for his calendar, but 365 days, 5 hours, 48 minutes, 45 seconds, his year was 11 minutes 14 seconds too long. This may seem too small a difference to be worth consideration, but it amounts to three days in four hundred years, and in the sixteenth century had accumulated to ten days.

The Muslim calendar is reckoned from the flight of Muhammad from Mecca to Medina, the date adopted for it being A.D. 622,

July 15. Its principle is essentially lunar; the year is made to consist of twelve lunar months, or about 354 days, the first month being given 30 days and the next 29 days alternately. In order to adjust this lunar calendar to the length of the solar year, the twelfth month is given 29 days nineteen times, and 30 days eleven times in a cycle of thirty Muslim years. This gives the length of a year as 354⅓ days, which is nearly 11 days short of a true tropical or solar year. As a result, the Muslim year retrogrades through all the seasons in about thirty-three years. Ramadan, the ninth month of this year, which is observed throughout Islam as a month of fasting, may thus fall in any season.

As all the movable feasts of the Christian Churches depend upon the date of Easter Day, and as this date is determined by the spring equinox, these religious events have thus a direct connection with astronomy. It is necessary to know the date of the spring equinox, and also the date of the first New Moon after it, before the date of Easter Day can be fixed. It was pointed out by Roger Bacon in the middle of the thirteenth century that the day of the spring equinox was gradually receding, so that a calendar date for the equinox at one period was not true after a certain interval of time.

On account of this astronomical effect, as well as differences of opinion between the western and eastern Churches as to the day on which the Paschal feast should commence, each side pleading different apostolic traditions in support of its custom, the Council of Nice was summoned by the Roman emperor Constantine the Great in A.D. 325 to arrive at an agreement for the date of Easter. The date upon which the Jews kept their Passover was the fourteenth day of the New Moon which happens upon or next after the twenty-first of March; and the Council of Nice decided that this should determine the date of Easter.

Socrates, the Church historian of the fifth century, records the announcement of the Council in their epistle to the Church of Alexandria in the words:

> "We also send you good news concerning the unanimous consent of all, in reference to the celebration of the most solemn feast of Easter; for the difference also has been made up by the assistance of your prayers: so that all the brethren in the east, who formerly celebrated this festival at the same time as the Jews, will in future conform to the Romans and to us, and to all who have of old observed our manner of celebrating Easter".

When the Julian calendar was introduced by Julius Cæsar, the

spring equinox occurred on March 25, but the date of the equinox adopted by the Council of Nice was March 21, which was really the date of the equinox in the preceding century according to Julian reckoning. The Council not only decided that the fourteenth day after the first New Moon upon or after the spring equinox should regulate the date of Easter, but also that Easter Day should be on a Sunday, and not any other day of the week. If it had been determined that Easter Day should be celebrated on the day of the first Full Moon following the vernal equinox, the dates could be easily calculated in advance from the knowledge of the length of the lunar month. What the Nicean Council decreed was that Easter Day must be celebrated on a Sunday, which made the determination of the dates much more complicated.

To avoid the confusion which must occasionally arise as to the date of Easter Day, a fictitious or Ecclesiastical Moon is used for the construction of the tables given in the *Book of Common Prayer*, and not the true Moon. It thus happens that sometimes, as, for example, in the year 1900, the ecclesiastical Full Moon fell on a different day at Greenwich from that of the real Full Moon. The fourteenth day of the Moon as laid down by Church authority is thus not necessarily the fourteenth day of the true Moon's age. For the preparation of the tables used in the Prayer Book, the lunar month is taken as having the lengths alternately of twenty-nine and thirty days, and this departure from the usual lengths of the months renders certain adjustments necessary to make the dates of the ecclesiastical Moon correspond closely with those of the true Moon.

To construct tables giving the actual calendar dates of Easter is, therefore, no simple matter. The spring equinox occurs on March 21, and Easter Day is the first Sunday after the Full Moon following this equinox, so that both the solar year and the lunar month are involved in the calculation. With the Hebrews, Assyrians and Babylonians the calendar was based upon the lunar month, and the month began when the thin crescent of the Moon was first seen. With the Egyptians, Greeks and Romans, however, the calendar became a solar one, and New Moon could, therefore, occur on any day in a month, as it does at the present time.

In the fifth century B.C. a Greek mathematician, Meton, found that there was the same number of days, within a couple of hours, in 19 solar years as in 235 lunar months. This relationship was regarded as of such importance that it was inscribed in letters of gold on Greek monuments from 1 to 19, and was called the Golden Number. The Metonic cycle was used by the Christian Church to determine the date of Easter during more than one thousand years. If a Full Moon occurs on any particular date in the cycle, no other

Full Moon will occur on the same date for nineteen successive years, but the cycle will begin again in the twentieth year with a Full Moon on that date. New Tables were constructed for determining the date of Easter on this cycle by a Scythian monk, Dionysius Exiguus, in the year A.D. 532, and the Golden Number 1 was given to that year.

It has already been mentioned that the date of the spring equinox in the time of Julius Cæsar was March 25 and that the Council of Nice adopted March 21 as the date. In the sixteenth century the date of the equinox according to the Julian calendar, which was then in use, was March 11, and at the present time, on the same calendar reckoning, it is March 8. It was the supposed necessity of making March 21, as decreed by the Council of Nice, the point of time from which to reckon Easter Day that led Pope Gregory XIII to introduce his reform of the calendar in 1582.

The alteration from the Julian style of time reckoning to the new or Gregorian style was not made in England until two centuries later, when Parliament enacted that the day following September 2, 1752, on the old style should be called the 14th instead of the 3rd, eleven nominal days being thus struck out of the calendar. It was also enacted that the year 1752 should begin on January 1, and not on March 25, as it had done previously in ecclesiastical and legal usage. In Scotland, the year began on March 25 until the end of 1599, when January 1, 1600, was made the beginning.

After the change from the Julian to the Gregorian calendar in 1582, adjustments had to be made in the tables used for the determination of Easter, to suit the new style. In 1724 the date of the Full Moon according to the Gregorian calendar was Sunday, April 9, while the date given by a certain table then in use was the day preceding. In that year, therefore, and also in 1744, Easter was celebrated by Catholics and Protestants on successive Sundays. Agreement was brought about by Frederick the Great in 1776 on the basis of the Gregorian calendar.

The tables used even now for the Church calculations of the dates of the Full Moon, and therefore of Easter Day, do not always give the actual dates of the Full Moon; and the difference between the "ecclesiastical" and the true Moon may be as much as a week. This is of no particular importance, but the fact remains that the date of the Christian festival upon which most other festivals depend is to-day decided by religious authorities, just as the dates of festivals were ordered by the priests in ancient Egypt five thousand years ago on the basis of astronomical observations.

Even though the actual dates of Christmas Day and certain holy and saints' days were not affected by the change of style of the

calendar, their positions in the season year were changed. In the time of Pope Gregory the difference was ten days, and this became eleven days in March, 1700, and twelve days in 1800. Christmas Day of the old style thus became Old Christmas Day, January 6, when twelve days were added, and is now January 7. Russian Orthodox Christians follow the old style and celebrate Christmas on January 7 and not on December 25 of the new style.

From 1500 to 1700, May Day—the first day of the month—was kept in England on the day corresponding by the season to what is now May 11; after 1700, until the alteration of the calendar in 1752, it would be May 12 by the new reckoning. At that time, therefore, the dancing around the maypole took place in England at what is now nearly the middle of the month, and not the beginning. This difference has to be borne in mind in connection with relationships between the dates of old festivals and the season. Thus St. Swithin's Day is July 15, but that date in the year 912, when the saint's body was moved contrary to his last wishes, corresponds in our calendar to July 28. *Poor Robin's Almanack*, published in 1697, refers to the well-known legend associated with St. Swithin in the words:

"In this month is St. Swithin's Day,
On which if that it rain they say,
Full forty days after it will
Or more or less some rain distil."

There is a certain amount of evidence that about this time of year showery weather is likely to occur in England, but there is none to support the belief that the weather for forty days after July 15 will be mainly wet or dry according to the conditions on that date. Moreover, from the point of view of the season, the beginning of the period over which St. Swithin's influence is supposed to exist ought now to be taken at the end of the month instead of the middle.

St. Swithin's Day is an example of a holy day observed on a fixed date in the year, and it differs from those which, in the ecclesiastical calendar, are movable festivals or holy days dependent upon the date of Easter as shown in the following list:

	Days before Easter		Days after Easter
Septuagesima Sunday	63	Low Sunday	7
Quinquagesima Sunday	49	Rogation Sunday	35
Ash Wednesday	46	Ascension Day	39
Quadragesima Sunday	42	Whit Sunday	49
Palm Sunday	7	Trinity Sunday	56
Good Friday	2	Corpus Christi	60



Photo. *E. N. S.*

THE TEMPLE OF THESEUS AT ATHENS. This faces eastwards, like the Dendera temple, which it resembles in style. Theseus was the Heracles of Greek mythology and was worshipped because of his heroic deeds, which included the killing of the Minotaur in Crete. The temple was erected over the spot where his bones were buried in the fifth century B.C. and it served as an asylum especially for artisans and in which public officials were chosen by lot. Hephaestus, the Greek god of fire and patron of craftsmen, had this "Theseum" as his temple. *(See Chapter VI.)*

The division of the day into twenty-four hours, each divided into sixty minutes, and these into sixty seconds, had its origin in ancient Mesopotamia. The year was divided into twelve months, each of about thirty days. Following this analogy, the Sumerians divided a day into twelve parts, each of which was sub-divided into thirty. The Babylonians afterwards divided day and night each into twelve hours, which change in length with the seasons. The Egyptians also followed this arrangement. Sixty is twice the number of days in a month, and was an important number in the Chaldean system of numeration. It was natural, therefore, to use it in dividing the hour into sixty minutes, and later, when accurate timepieces were constructed, for minutes also to be divided into sixty seconds.

There is no evidence that the Hebrew week of seven days, the last of which was hallowed, as described in the Holy Bible, was associated with any astronomical period, or with the lunar month. The names formerly used to designate the days of the week were, however, of astrological origin, inasmuch as they suggest planetary influences upon human affairs. In early charters and deeds they are given as follows:

Dies Solis	Dies Dominica	Sunday
	Dies Lunae	Monday
	Dies Martis	Tuesday
	Dies Mercurii	Wednesday
	Dies Jovis	Thursday
	Dies Veneris	Friday
Dies Sabbati or	Dies Saturnii	Saturday

The last day of the week was always called the Sabbath Day in the Middle Ages, and its designation as Dies Saturnii came in later.

The present English names of the days of the week are of Scandinavian and Anglo-Saxon origin. Sunday remains the day of the Sun and Monday the day on the Moon; Tuesday is derived from the name of Tiw, the Scandinavian Mars or god of war; Wednesday is the day of Wotan, or of the god Mercury; Thursday is the day of Thor, god of thunder, ruler of heaven and earth, and corresponding to Dies Jovis or Jupiter of the Romans; Friday is the day of Friga, queen of Wotan and goddess of love; and Saturday in Anglo-Saxon is Seterne's day.

The number seven has always had a magical or mystical significance in religious beliefs. In Egypt the idea that a man has seven souls can be traced back to the earliest dynasties, about six thousand years ago. In Babylonian and Assyrian magical texts, seven evil spirits of the deep are mentioned; and the Mesopotamian under-

world possessed seven gates. Each of the seven planets (the Sun and Moon among them) was given divine attributes. There were seven champions of Christendom in medieval times, seven cardinal virtues, and seven deadly sins.

The relation of the ecclesiastical festivals to an earlier calendrical system and pagan creeds is indicated both by the seasons of the year at which they are held and by a number of popular observances associated with these seasons. These are found, or were found until recently, among the European peasantry, and their character clearly points to the fact that they are survivals from a long-forgotten and pre-Christian form of religious belief. Just as the Jewish feasts of the Passover and Unleavened Bread were an inheritance from the practices of a pastoral and an agricultural people respectively, so the Christian festival of Easter took the place of a pagan celebration of the renewal of the energies of the living forces of Nature with the coming of spring.

In like manner and on similar evidence it can be shown that each of the major festivals of the Christian calendar carries on the tradition of earlier pagan beliefs, which the early Church, with a wisdom which still persists in Roman Catholic missionary effort in its relations with primitive peoples, had adopted into and transformed in the service of the Christian faith. For example, the feast of Candlemas on February 2 is a fire festival in which, at the renewal of agricultural operations, the evils of the past dead season of winter are driven out by the magical powers of fire; and the Festival of the Purification of the Virgin Mary on the same day is a survival of the invocation of the mother-goddess in a ceremonial for the renewal of the powers of fertility in the coming spring.

Easter Day, the greatest of the three great festivals of the Christian Church, is shown by a number of ecclesiastical and popular observances to be associated with the regaining strength, or annually recurring resurrection, of the Sun. The English word Easter is itself derived from *Eostre*—the name of an Anglo-Saxon goddess whose festival was celebrated at the spring equinox. During the Easter period white is the liturgical colour, to signify light and unsullied life. Whitsuntide begins with the seventh Sunday after Easter, and was known in Old English as White Sunday because of the ancient custom of the wearing of white baptismal robes by the newly baptised on the same day of Pentecost—a word of Greek origin signifying the fiftieth day or feast and adopted as the name of a Jewish harvest festival.

Whitsuntide observances include a number of folk-dances and other widely-distributed customs in which the spirit of vegetation is involved, leading in some places to its ceremonial sacrifice. The



Photo. *E. N. S.*

An aerial view showing the square and basilica of St. Peter's, Rome, the largest of the Christian churches, and the gardens of the Vatican. The present structure was completed in the seventeenth century and the tomb of St. Peter is beneath it. The obelisk in the foreground was brought from Heliopolis in the first century A.D. and was placed in its present position in 1586. (*See Chapter VII.*)

chief actor impersonates the dead winter, and its rejuvenation in the character of the young and vigorous spring takes part. In the early Christian Church the Morris dances of Whitsuntide took place in the chancel or in the church tower, until they were forbidden because of their pagan character.

May Day Eve and May Day, which do not appear in the Church calendar (their function there having been assumed in part by Whitsuntide, in part transferred to the Feast of St. John the Baptist at midsummer) were until recent times the most important rustic festivals of the year over the greater part of Europe. It was a time when witches and the powers of evil were specially potent. Hence the fire festivals and May fires which protected man, his crops and his farm animals against these evil influences; and it was also the period of the renewal of fertility and of the forces of life in high spring, symbolized in the phallic observances, dances and ceremonial of the maypole.

The popular observances which obtained among the peasant population of the countryside in connection with the Feast of St. John, June 24, were of a kind to be attributed for the most part to a survival of sun-worship. Such, for example, are the vigils associated with Stonehenge and other stone circles, and also in part the midsummer bonfires—measures which increase the power of the Sun, as the year progresses towards the harvest. These bonfires were also believed to drive away evil influences from the ripening crops, thus carrying on the function of May fires.

At the feast of Lammastide in August, with the timely ripening and gathering of the harvest, a brief period of leisure in the farmer's year is in view. It is celebrated by family and tribal gatherings, at which marriages, transfers of land and property, and other matters are arranged, and athletic and similar contests of skill take place. Memory of these gatherings is preserved in the athletic meetings still held among the Celtic-speaking peoples of Britain and Eire—the Highland Games, the Talltown Games, and the great gathering of Wales, the Eisteddfod, in which the glories of the Druidical contests in all the arts are renewed.

Michaelmas, with Hallowmas or All Saints Day on November 1, and the Feast of All Souls on November 2, have subsumed, in the Harvest Festival and the celebration of the memory of the Blessed Dead, both the pagan feasts of the first fruits. Without this offering to the gods it was not safe for the farmer, his household, or his stock to partake of the newly-gathered fruits of the Earth; and with the November celebration of the feast of the dead, the Celtic and pagan year began. The memory of this Celtic year, beginning in November, long survived in the custom found in England, certainly

until a few years ago, of hiring farm hands, male and female, for the following year, at the country fairs held at the beginning of November.

Many interesting survivals connected with the Feast of St. Nicholas on December 6—among them the German Santa Klaus which has been transferred to Christmas—must be passed over, in order to touch briefly on the festival of Christmas on December 25, which is, from this point of view, the most interesting and illuminating in the whole calendar. While in theory the Christmas season celebrates the birth of Christ, in fact (as is well-known) it does nothing of the kind, as the date on which Jesus was born is uncertain. Christmas is a pagan festival, which was adopted for the celebration of the Nativity about the middle of the fourth century in order to wean converts from pagan ceremonials taking place at that season.

Before that time Oriental Christians held an annual festival on January 6 to commemorate the appearance of the miraculous star which is said to have led the Magi to Bethlehem, and they used that date to celebrate both the birth and baptism of Jesus. The Western Church afterwards adopted January 6 as the date of the Epiphany, which signifies the appearance of the celestial light, now interpreted as "spiritual", without reference to the birth and baptism of the Christ. December 25 was made the day of rejoicing, as it had been used long before to celebrate the passing of the shortest day. The custom was to keep fires kindled for the twelve nights from December 25 to January 6, and this was an adaptation of the celebration of the "Unconquered Sun" to a Christian festival.

In Northern Europe it is the mid-winter festival of Yule, which the associations of the Yule log and other customs would assign to a derivation from sun-worship; in Southern Europe it is mainly, though not solely, a festival of the mother-son worship (with a shadowy father, Joseph, in the background, as seen in the Mangers of the Christmas celebrations of Mediterranean peoples to-day) which can be traced back through the ages as the dominant cult of the Mediterranean. This cult is derived from the prehistoric Anatolian plateau, for which view there is support in the numerous images of mother and child found among the earliest antiquities of the fourth millennium B.C. from Erech in Mesopotamia.

An interesting point arises out of the celebration of Christmas as popularly observed in Britain. A double strain is to be observed. While as a whole the feastings and rejoicings of the Yule ceremony predominate, the Manger, which is the most conspicuous feature of the popular celebration in Mediterranean countries, also appears in England with other associated customs. It was once customary for

children to construct a Manger, which they carried round soliciting alms. The two forms of celebration belong to entirely different systems of belief, and it is evident that in Britain a double strain of tradition, deriving from north and south, has survived.

Whether the second element in the Christmas tradition, the Manger, was introduced into England in post-Christian times, or is a genuine survival from the prehistoric Mediterranean strain in the British racial make-up, cannot be discussed here. It is, however, interesting to note that the racial strains which make up the British population appear each to have contributed something to the traditional non-Christian calendar. The basis of this calendar, on the evidence of popular rustic custom, was a year divided into two six-monthly divisions, one beginning in May and the other in November.

This is a pastoral year, in which the ceremonies and observances of the May festival mark the removal of the flocks and herds to their summer grazing grounds; while in November the animals were brought back with appropriate ceremonial to their winter quarters, and those animals for which the sparse pasturage of the winter would not suffice were slaughtered and the meat preserved. In Scotland, down to quite recent times, the custom survived of salting all beef at this period of the year. On this pastoral calendar was superimposed an agricultural year divided into four quarters, in which the division was marked by festivals showing their mainly agricultural origin, at the beginning of February, May, August and November. Even this, however, does not complete the tale of the development of the British calendar. The intrusion of northern European peoples, predominantly Nordics, with a tradition of sun-worship, once more diverted the divisional points of the year to December and midsummer, with a spring festival at what is now Easter.

The dates of all these annual celebrations are clustered around observations of signs and wonders of the sky and seasonal changes, while their association with religious festivals represents the worship of causes behind the celestial phenomena.

VII

SUN-WORSHIP AND TEMPLES

THE more mysterious any natural object or event, the more likely it is to be held sacred and to be worshipped. In early stages of mental development, it is more reasonable to think of water, rocks, plants or animals as possessing the powers of speech and other human qualities than to give them actual personalities. To the primitive mind, a moving thing suggested the presence of a living agent. The stars and planets, Sun and Moon, moved because they seemed to be alive; and hence they became objects of worship. The phenomena of inanimate Nature were interpreted as manifestations of supernatural life, and among many peoples were thought of as men and animals and other living things.

Realization of the influence of the Sun upon all forms of life, the fertilizing effects of rain, the succession of seasons, and the association of the Moon with all of them and with the darkness of night, qrecedes deliberate attention to their causes and represents instinctive reactions to purely physical phenomena. At a later stage of human development primitive peoples regard things as having a spirit within them and they use this word, not in the sense of "ghosts" or personalities, but in that of power or unseen and uncontrollable means of action. Later still, human qualities such as thought and mind are attributed to celestial bodies, which are believed to possess or symbolize them.

Worship in the sense of adoration or reverence of the spirits of ancestors may be said to represent recognition of intrinsic goodness in human nature and the desire to maintain it by domestic rites.

This and other qualities, such as sympathy and justice, are characteristics of all human communities, even though attachment to them differs from place to place and from time to time. In religion their origin is ascribed to external and supernatural influences, which are worshipped as sacred; but, even so, the attributes with which the gods of the ancient world were endowed were those admired or feared by the feelings of men who created them.

Desire and pleasure, as celebrated in spring and harvest festivals everywhere, are more primitive expressions of community feeling than worship of personified powers by prayers and supplications.

For the exercise of the virtue of gratitude, deities had to be seen or human qualities attributed to them or their creator. The Sun in its glory or radiance thus became the chief object of worship among many peoples, in some places as a living thing and in others as the abode of a spirit or as a god.

In the religion of Sumeria, Babylonia and Assyria the gods represented natural objects and phenomena, and animal forms were given to them. These primeval forms were superseded by celestial bodies, among which the Sun and Moon took the highest places and were worshipped because of the human feelings attached to them. The Sun-god, Shamash, was the son of the Moon-god, Sin, and the two formed a trinity with Rammanu or Adad, god of the atmosphere and weather. Shamash became the judge and source of law, and prominence was given to the worship of him from the earliest times in Babylonia and Assyria, higher ethical levels being associated with him with the advance of humanistic thought.

The principal annual festival in Babylon was that celebrated in March, and it commemorated the life and history of the national god, Marduk, who conquered the primeval gods and was the mythological creator of the universe as it was then known. There was a great and solemn procession and the performance of a dramatic play based on these events, like the miracle-plays of medieval times in Christendom. Another great festival, in the autumn, celebrated the annual death of the god Tammuz and his resurrection brought about by the goddess, Ishtar, twin-sister of the Sun-god, who typified fertility and other human attributes and was thus associated with the re-birth of all vegetation.

These and similar celebrations had their origin in the people called the Sumerians, who appear to have come from Central Asia about 4500 B.C. and to have settled in southern Mesopotamia, where their mythology was adopted and developed by the Babylonians and Assyrians. The early Sumerians were peasant farmers, possessing domestic animals and cultivating corn with flint implements. By about 2800 B.C. they had become urbanized and the territory was divided among a number of City States, one of which, Erech, had an area of two square miles. They instituted a system of public worship with formulated religious rituals directed exclusively by the priests, one class of whom also practised primitive medicine. As with other early peoples, the priesthood exercised by their knowledge a dominating influence upon the patterns of both social and sacred systems.

In every Mesopotamian city the most imposing erection was the temple, a monumental structure of brick, dominating and dwarfing

all other buildings—the home and dwelling-place of the patron deity of the city. It stood in its own enclosure, which was surrounded by a wall, forming an interior, or secondary, fortification. In its more highly elaborated form it was raised on a succession of terraces, ascending spirally from the ground to the summit. Thus it formed an impressive staging for the elaborate ceremonial processions, in which an image of the deity, or perhaps the high priest —his or her representative on earth—participated, attended by a train of lesser priests and worshippers. This succession of terraces led up to and culminated in the *ziggurat* or observatory tower, which looked out over city and plain; topping the city mound with its brightly coloured walls, it formed a conspicuous object visible for many miles in the flat monotonous landscape.

The dominance of the temple tower over the city and its surroundings was symbolic of the place of religion in the organization of the life of the citizen. The high priest was the ruler of the city, and the people were his subjects in virtue of his priestly office, as the high god's earthly representative, to whom they paid tribute of sheep, cattle, and other produce of their industry, as sacrifice to the gods. The temple organization in its most advanced form of development is perhaps best to be appreciated in the temple of the Moon Goddess of the Third Dynasty of Ur (*c.* 2400 B.C.), which was excavated by Sir Leonard Woolley. The dedication of this temple to the Moon Goddess was natural to an agricultural people, whose calendar was regulated by the Moon and whose seasonal occupation of cultivation of the soil and the care of flocks and herds, as well as their addiction to divination, constrained them to watch the apparent motions of the stars and planets.

The elaborate decoration of the temple of Ur, with its friezes of copper, on which bas-reliefs depicted activities connected with the care of the herds, brings out clearly the close relation of ritual, industry and art, which must have been ever present in the mind of the citizen. This relation is even more intimately stressed when, as at Tell Asmar, the temple sculpture represented the deity and chief ministrant in the ritual performance of the central act of the fertility cult, which with living participants survived in Babylonia down to historic times, as may be inferred from the accounts of Herodotus and others.

Life for the peasant farmer of Mesopotamia was a constant and never-ceasing struggle between the desert and the sown; and the effects of this struggle were no less deep-rooted in the minds of the urban population, whose very existence in the last resort was bound up with the land. Not only did the fertility of their fields depend upon irrigation, which needed constant care—Babylon was far-

noted for its waterways—but also the flocks and herds were at the mercy of the apparent caprice of disaster by flood and tempest, especially lightning and sandstorm. Of these anxieties no more striking picture could be found than in the catastrophies of the story in the Book of Job.

It is, therefore, no matter for surprise that throughout Mesopotamian history the religion of the people, in addition to the worship of the high gods, who must be propitiated by sacrifice, is gravely preoccupied with a thronging world of spirits. Their evil attentions must be averted by spells and charms, and their intentions and interferences with daily life are forecast by divination from the stars, the inspection of the entrails of sacrificed animals, and other means. The story of creation, which is echoed in the Biblical version, tells of the emergence of the world from chaos in the struggle between the powers of good and evil. This appears also in the story of the Garden of Eden and the Fall under temptation by the Serpent.

The dualistic symbolism of the struggle of ordered life against the almost overwhelming forces of the environment was a central theme of Mesopotamian religious belief for some thousands of years, as is shown in the innumerable tablets which have been recovered by archaeological exploration among the temple records. Under the Assyrian empire the powers of evil are regarded as embodied in the hideous forms of demons, who figure prominently in Assyrian art. Finally, the belief in this conflict was absorbed in the kindred faith of the struggle between Ormuzd and Ahriman, which was introduced by the Persian conquerers on the fall of Babylon.

The temple records were, however, not solely and exclusively concerned with religious matters. The temple was the centre of the city's administrations, of its law, and of its academic and commercial activities. The decrees of the ruler and the records of his acts appear equally with the regulations by which the varied life of the community was governed—later to be embodied in legal codes. Thus Sargon of Akkad (2550 B.C.) and his successor, Naram Sin, record their conquests and the bounds of the territories over which they ruled; while the former sets forth the details of the measures he had taken for the improvement of communications within his empire. Of the legislative measures of the Mesopotamian rulers, the most famous is the code of Hammurabi of Babylon, the contemporary of Abraham, sometimes identified with the Amraphel of the Bible.

Wonder and awe at the sublime panorama of the heavens thus led to worship of the objects in them, whether regarded as living deities or as spiritual symbols. Determinations of the regular succes-

sion of celestial phenomena were not made with religious motives but as time-measures affecting the material needs of life. Systematic observations undertaken for these purposes belong to the practical astronomy of their day, just as much as those tabulated year by year in a modern *Nautical Almanac*. When they are associated with human natures and affairs they have contacts with both science and religion, and astronomy becomes the handmaid of astrology.

In organized public worship the basis of the calendar of the liturgical year is astronomical observations of particular positions of the Sun and Moon, annually or monthly. At the summer solstice, the Sun is at its highest position in the sky and the noonday shadow of a fixed point is then shorter than at any other time of the year, and hours of daylight have their greatest length. At the winter solstice, the Sun reaches its lowest noonday position and the nights are at their longest. Between the two solstices are the spring and autumn equinoxes, when days and nights are of equal length both north and south of the equator. This means that the Sun then rises due east and sets due west, and that peoples who made particular use of this line of direction in the building of temples or other sacred structures would use one or both of the times of the equinoxes for their chief celebrations. In Mesopotamia, the Tigris and the Euphrates began to rise annually near the time of the spring equinox, which became, therefore, the season of the renewal of the fertility of the Earth and of worship of its cause.

As the rising of the Sun due east in March and September provides an easily observable starting point from which to begin a seasonal year, many early peoples who have made use of the equinoxes in time-measurement have used the east and west direction in laying down the main lines of temples and other structures, such as pyramids. The rising Sun would thus shine straight along these lines on New Year's Day, and the association of the light with a personal deity gave an astronomical event especial significance in religious worship.

Josephus relates that the temple built by Solomon at Jerusalem was open to the east and closed to the west. The light from the morning Sun at the equinox was thus free to pass through the temple until it reached the "Holy of Holies", where it was reflected from jewels on the altar or on garments worn by the priests. The worshippers had their backs to the Sun, and its reflected rays seen by them was interpreted as a sign of God's presence at their sacrifices.

The great annual Feast of Tabernacles was held in the autumn month of Tishri and was a feast of thanksgiving for the gathering in of fruits and the vintage. There are references in the Hebrew Scrip-

tures to this seventh month as beginning a new agricultural year, but the first month was that of Nisan or Abib, near the spring equinox, and it was from the fourteenth to the twenty-first of this month that the sacred national festival of The Passover was celebrated. The autumn festival had its origin in a Babylonian cult, but the structure of Solomon's temple itself, with the bright and wide opening court leading to the veiled and dark inner sanctuary, in which was kept the Ark of the Covenant, followed the same general lines as those of Egyptian temples.

The oldest known example of a stone Egyptian temple or "house of the god" is that at Sakkarah built about 3000 B.C. as the tomb of King Zoser, who was deified and worshipped as the god of medicine and science. It represents a remarkable architectural development into the pyramid form from the oblong shape, with the four walls sloping upwards, commonly used for tombs of royal personages and nobles. The entrance to such a tomb is usually on the east side. The shrine itself contained the remains of the revered dead, with everything to administer to the needs and desires of its "soul" or "double" in an after-life which would resemble life upon the Earth.

Offerings of meat and drink and burning incense were made at these burial places, and by the side of a pyramid a temple was often erected for worship of the spirit of the shrine. Attached to the Great Pyramid of Cheops at Gizeh, for example, there was a temple in which commemorative services of this kind were performed. The temple pointed due east and was dedicated to the goddess Isis, who watched over her son Horus, symbolized in the rising Sun.

The pyramids were thus a particular form of sacred grave which was afterwards superseded by tombs hewn in the sides of rocky cliffs. They were constructed with geometrical accuracy and their base-lines were determined by astronomical observations, but they were graves which became funerary temples and were revered as such, just as the graves of Christian saints and kings came to be honoured in later times.

The group of massive stones at Stonehenge on Salisbury Plain, Wiltshire, is a similar sepulchral monument constructed at a very remote date. Inside the remains of a circle of great pillars is a block of sandstone known as the Altar Stone. Two earthen banks which extend for a considerable distance from the structure form an "avenue" which is in the general direction of sunrise at the summer solstice as seen from the Altar Stone. People still go to Stonehenge at dawn on the longest day to see the Sun rise in this way. The structure thus seems to have been erected for the practical purpose of marking the annual return of the rising Sun to a particular point

on the horizon, whether it was used as a solar temple or as a sepulchral monument only. Whatever view is maintained, the astronomical fact remains that the Sun rises in the direction of the axis of the structure on the longest day.

To the Egyptians the daily movement of the Sun across the vault of heaven typified the life of man from his birth in the morning, through maturity at noon, and ending with death at its setting. But just as the Sun renewed its youth and vigour every day, so it was believed that, after the death of the natural body, the heart, or spirit, or soul *double* of life, continued to exist in the tomb or in the underworld of which it was a spiritual part. Amon-Ra, or Ra, was the king of the gods and was represented by the Sun. There were many other "gods" to whom supernatural attributes were given, but Ra or Amon-Ra was above them all as the "only one" who, like the god of Israel and Islam, had no second or equal.

Both the art and the literature of the Egyptians were in the main the product of their religious belief in a future existence, in which the legend of Osiris was connected with the doctrine of eternal life. In Egyptian mythology, Osiris was slain by his brother Set, the personification of night and evil, who in his turn was overthrown by Horus, the rising Sun, and the heir of Osiris. At sunset Osiris died every day and was renewed every morning in the name of Horus.

The body of religious compositions known as *The Book of the Dead* is the chief source of knowledge of these beliefs, from the first record in the time of the pyramids of the Fifth Dynasty (*c.* 2750 B.C.) to the latest forms in the early centuries of the Christian era. This work consists of a collection of funerary texts which the ancient Egyptian scribes composed for the benefit of the dead; and it includes spells and incantations, hymns and litanies, magical formulae and names, words of power and prayer, found cast or painted on the walls of pyramids and tombs and engraved on coffins, sarcophagi, and rolls of papyrus.

During the reign of Amenhetep IV, otherwise known as Ikhnaton (1380–1362 B.C.), in the Eighteenth Dynasty, the Sun-god was worshipped as the one and only god—a belief which was, therefore, monotheistic. Amenhetep IV abandoned his name when he rejected the cult of Amon, or Amon-Ra, and adopted the new name of Akh-en-Aten, or Ikhnaton, signifying "The Blessed of the Disk". He then separated himself from the priests of Amon at Thebes and established his new capital at Tell el-Amarna, on the east bank of the Nile, nearly two hundred miles south of Memphis. He was a heretic and monotheist, and his reign and his reform lasted less than twenty years, yet the really religious literature of Egypt reached its culminating point in this period. To him the Sun was the visible

symbol of the god Aten, and not the great Sun-god Ra himself, who was believed to have created the hundreds of other gods worshipped by the Egyptians.

Philosophic insight as well as poetic beauty are manifest in Ikhnaton's noble "Hymn to the Sun-Disk", which contains the following passage, among others of high religious expression:

> "Thou makest the seasons to preserve all that thou hast created—the winter to cool and the flood. Thou hast created the heavens afar, to go up into them, that thou mayest see all that thou hast made. Thou art One, but thou ridest in thy form as the living sun, appearing shining, giving, and returning. . . . Thou art in my heart, and none knoweth thee as doth thy son Akhenaten whom thou hast deigned to let comprehend thy thoughts and thy strength".

Whether, apart from the teaching of Ikhnaton, the Sun was worshipped as the god himself, or his symbol, also whether even the educated priests believed in one or many gods, is not altogether clear, and authorities differ in their decisions. It is known that numerous family and tribal gods and other primitive conceptions were worshipped, yet it is possible to recognize three main elements in the religion of Egypt. They are: a solar monotheism, or a god specially manifested in the Sun; the worship of the regenerating powers of Nature, including man; and an anthropomorphic divinity.

The sequence in time of these phases of faith is doubtful, and they ultimately became intermingled in a very confusing manner. It may be assumed that the less exalted views prevailed before those of a higher type, and that, in the development of one into the other, many primitive beliefs and practices would be retained in modified form long after their original character had been forgotten. This evolution of ideas, and of sacred rites and ceremonies, is common to all religions, including Christianity.

The glory, radiance and heat of the Sun have been used by many writers to illustrate Christian belief and doctrine. The promise of increasing hours of sunlight after the season of darkness was interpreted as the Advent of the Holy Nativity, and is commemorated during the weeks preceding the shortest day. Christ became a ray of spiritual light from the eternal fire and the Holy Ghost another aspect of the indivisible Godhead. With the birth of Christ came a new dawn and in three-and-thirty years He rose higher and higher on the wings of the morning until His Crucifixion, of which the dying Sun in the evening was an emblem. His Resurrection was the pledge of a Resurrection morning of the Blessed Dead, when their

Sun would never more go down nor the morning of their beatitude ever darken into an evening twilight.

There is a close resemblance between these mystical interpretations of the Sun's effulgence and those enmeshed in the religion of ancient Egypt, and it is typified in many hymns used even to-day, as, for example in this opening verse:

"Sun of my soul, Thou Saviour dear,
It is not night if Thou be near:
O may no earth-born cloud arise
To hide Thee from Thy servant's eyes."

Metaphors of this kind are common to most religions and are vestiges of worship of the Sun in spirit or in truth. They represent intuitive human reactions to unseen influences to which names or a name have to be attached, whether that of an actual object or an idea. Their emotional expression is just as natural as are responses of the eye and other sense-organs to external forces. As the Sun is the visible source of all life and light on the Earth, so it becomes also the symbol or image of primary spiritual power.

Evidence of the devotional regard paid to the Sun in Mesopotamia and Egypt survives not only in the records of how the lines of temples were laid down and in the remains of many of their great structures, but also in the directions in which many Christian churches were built.

When, for example, the basilica was constructed at Rome on the Vatican hill over St. Peter's tomb by the Emperor Constantine I. in the fourth century, it had the great doors of the porch facing east, so that the rays of the rising Sun at the equinox passed through the outer and inner doors and the naves until they illuminated the High Altar. The majestic church of St. Peter's completed on the site in the seventeenth century follows the same directional conditions in the design to face the rising Sun at the equinox. This was common in the earliest Christian churches, the priest at the altar facing the worshippers and the Sun while the congregation had their backs to it.

In all Byzantine churches, however, as in St. Sophia, Constantinople, and in the early churches of Syria and the Coptic churches in Egypt, the altar was placed at the east end, and after the sixth century this became the custom in the architecture of the Western churches. The turning towards the east by worshippers in these churches did not have its origin in the direction of the Holy Sepulchre at Jerusalem, or the place of Christ's Nativity, but in the much earlier pagan observance of the rising Sun at the autumn and spring equinoxes.

The east-and-west direction of the main axis of places of worship came originally from Babylonia and represents a religious cult which began the liturgical year at one of the equinoxes. It is found in the lines of certain temples of great antiquity in Egypt and is associated with the fact that two sides of the pyramids have this direction. There were temples pointing to the sunset at the equinox and others pointing to the rising Sun, and in each case they were built in relation to the foundation plan of the pyramids.

The earliest type of pyramid in Egypt is that at Sakkarah which rises to a height of about two hundred feet in six broad "steps or terraces", each about thirty feet high. The ziggurats of Chaldea, Babylonia and Assyria were similar in form, rising to the summit in seven storeys, which were dedicated to the seven planets and were of different colours. These temple-towers were shrines of deities and were used as astronomical observatories. The Tower of Babel mentioned in the Bible was believed by the Babylonians to have been built by the gods themselves.

When Manasseh was king of Judah in the seventh century B.C. he introduced the worship of "all the host of heaven" and built altars for them in the two courts of the temple at Jerusalem. His son Amon worshipped the same celestial bodies but this cult was abolished by Josiah, who succeeded him, and Jeremiah—a contemporary of Josiah—describes how all who had followed the idolatrous cults of the Sun and Moon and the rest of the host of heaven were to be utterly destroyed. The "chariots of the Sun" which Josiah burnt with fire were sacred to the Babylonians and were emblems of the belief that the Sun was carried in a horse-drawn car or chariot daily across the sky, to sink into the sea at sunset. In Greek mythology, the god travelled over a subterranean sea during the night, and upon arriving at the eastern horizon the chariot and horses awaited him for another day's journey.

Worship of the Sun in a religious sense never occupied a high place in ancient Greece, though there were annual processions in honour of the Sun and the seasons, and temples were built so that the light of the rising or setting Sun could shine directly into them at particular times of the year. Rhodes was, however, sacred to the Sun, which was worshipped there above all other gods. The "Colossus of Rhodes", one of seven wonders of the world, erected in the third century B.C. and destroyed by an earthquake, was a gigantic statue of the Sun-god, Helios.

As personifications of the Sun, the Greek god Helios and the Sol of the Romans were similar to the Mesopotamian god Shamash and the Egyptian Ra in representing physical and moral attributes to be glorified by worship. The Sun-god of the Vedic Indians was Surya,

son of the sky-god Dyaus, and several hymns of the *Rig Veda* are devoted to him as the Sun itself or as a divine being. There are other solar deities in the Hindu faith, and the Sun is no longer worshipped as a great god, but as a godling or hero occupying it. As with other peoples, the Fire-god, Agni, was a great god of the ancient Aryans and was related to the Sun.

Among many primitive peoples fire is as sacred an object of worship as the Sun. Moloch was the fire-god of the Ammonites and children were sacrificed upon his altars. With the development of higher humanistic feelings, selected animals instead of children came to be used as burnt offerings. There are small communities of Parsees in parts of Persia who still regard fire with reverence and would not throw anything impure into it. To modern Parsees, however, fire is a symbol and not a real object of worship. Their religion was founded by Zoroaster in the seventh century B.C., a little before the rise to power of Cyrus the Great. Its central idea was the individuality of man and his responsibility to the Universe: God was called Ahura Mazda (Ormuzd). The Sun was the eye or focus of this universal influence and was represented in the sacred or perpetual fire of the priests.

The holy book of the Parsees, containing the words of Ahura Mazda as revealed to Zoroaster and prayers to the god, is called *Avesta*, but when new interpretations and comments were afterwards introduced the whole work was then given the name *Zend-Avesta*. In this devotional work the references are mostly to the Creator of the Sun and not to the object itself, thus following the course of development in other religions. The Wise Men, or Magi, who came from the east to worship the infant Jesus, bringing with them the three gifts of gold, frankincense and myrrh, were probably Parsees.

In the Shinto faith of Japan, the ancestral Sun-Goddess and the deified Rain-storm form a divine triad with the Moon-God and preside respectively over the Plain of High Heaven, the vast expanse of Ocean, and the realm of night. Of these deities, the most eminent is the Sun-Goddess, personified in the object itself which gives light and warmth to man. Thousands of pilgrims ascend the sacred mountain of Fujiyama from July to September every year to worship the Sun and pray for blessings. In Japanese mythology, the Sun-Goddess and the Rainstorm were the ancestors of a grandson who descended from the Plain of High Heaven to the Earth and became the founder of the Japanese Empire, with the sacred mission to continue the Imperial lineage "unbroken and prosperous, co-eternal with Heaven and Earth".

Every Emperor of Japan thus became the Jinno or Divine Ruler of a people held to be chosen above all others to possess the Earth.

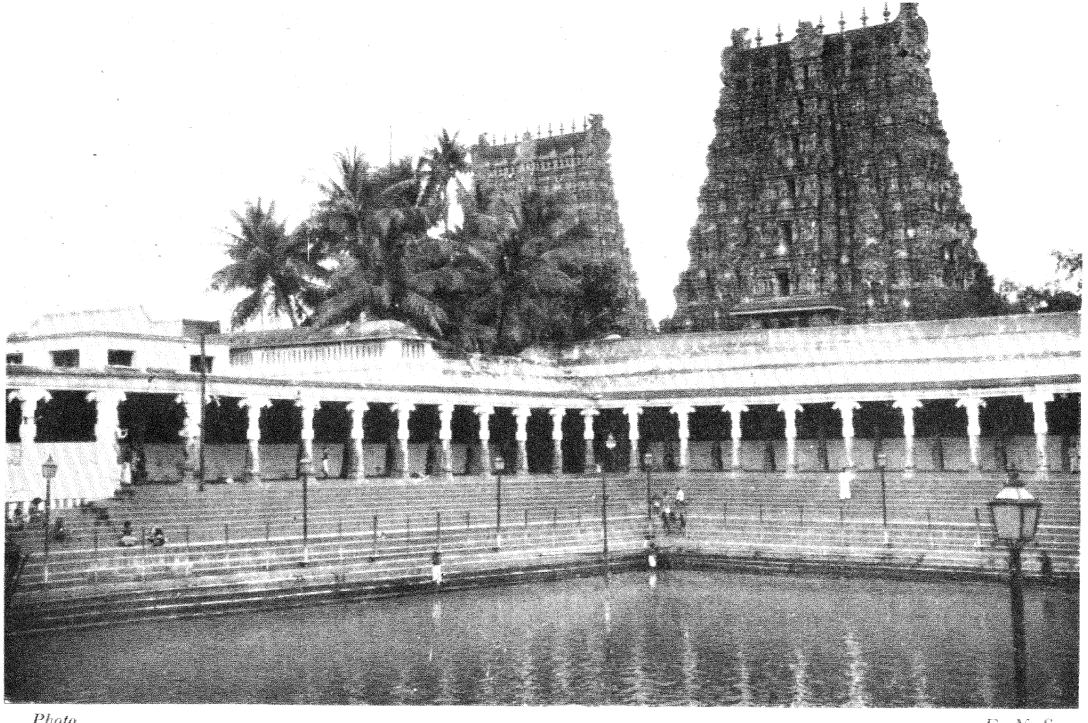


Photo. *E. N. S.*

TEMPLE AND SACRED LAKE OF THE GODDESS MINAKSHI—consort of Siva—at Madura, Southern India, built in the sixteenth century. The site of the temple forms a parallelogram measuring nearly 300 by 250 yards, and upon it are nine gopuras or pagodas of great height, all the tiers of which are elaborately carved with figures of Hindu gods, goddesses and demons. (*See Chapter IX.*)

Abjuration of the beliefs taught by Shinto has, therefore, been regarded not only as national treachery but also as blasphemy to a Divine Ruler. The combination of Imperialism with this religious faith was used as the driving force by militarists in Japan to create the fanatical fervour by which it was hoped to gain the world, or to acquire dominion over the greater part of it, in the years 1941–1945.

The supreme ruler, the Inca, of the Peruvian tribe of that name before the country was conquered by the Spaniards, was similarly regarded as a god on Earth and a descendant from the Sun. The ancestors of the tribe were all accepted as divine in origin, and the eldest of four brothers was the high-priest of the tribal god, the Sun. It was under his directions that Curco became the site of a great Sun-temple, and afterwards the seat of the Inca Empire was established. In certain temples of the Incas, who called themselves the Children of the Sun, the entrances were placed diagonally in relation to one another, so that a beam of the rising Sun penetrated the temple and fell precisely and solely on the altar which stood in the inner sanctuary.

Sun worship is a recognition of the dependence of physical life upon the radiant beams of a visible object external to the Earth. The Sun itself has at different times and among different peoples been regarded as a living thing and as the abode of a soul or divine being worshipped as a god. All these attitudes represent acknowledgement of supreme powers external to man and to which he looks for the support and guidance of his body and spirit. The Sun and other celestial bodies were first worshipped because they were observable objects. Later, these bodies become symbols of good or evil influences with the Sun as their chief agent. The way of their creation could only be imagined, but primitive peoples could not conceive of visible and tangible things being produced out of nothing. They could, however, worship the Creator, or Creators, of the wondrous works shown in the heavens and the Earth and in themselves as real things associated with the idea of Father Heaven and Mother Earth. Even among negro races of Africa, where Sun-worship is unusual, the god of the sky is invested with human attributes as the benefactor who sends rain for the fruitful fields to which they look for their daily food.

It has long been known that the human eye is sensitive only to a very small portion of the range of waves continually being broadcast through space by the Sun and Stars. At least sixty octaves of such vibrations are known to exist, yet only a single one is detected in the gamut of optical vision of colour from dark red to deep violet. They are all electro-magnetic radiations and certain of these, when

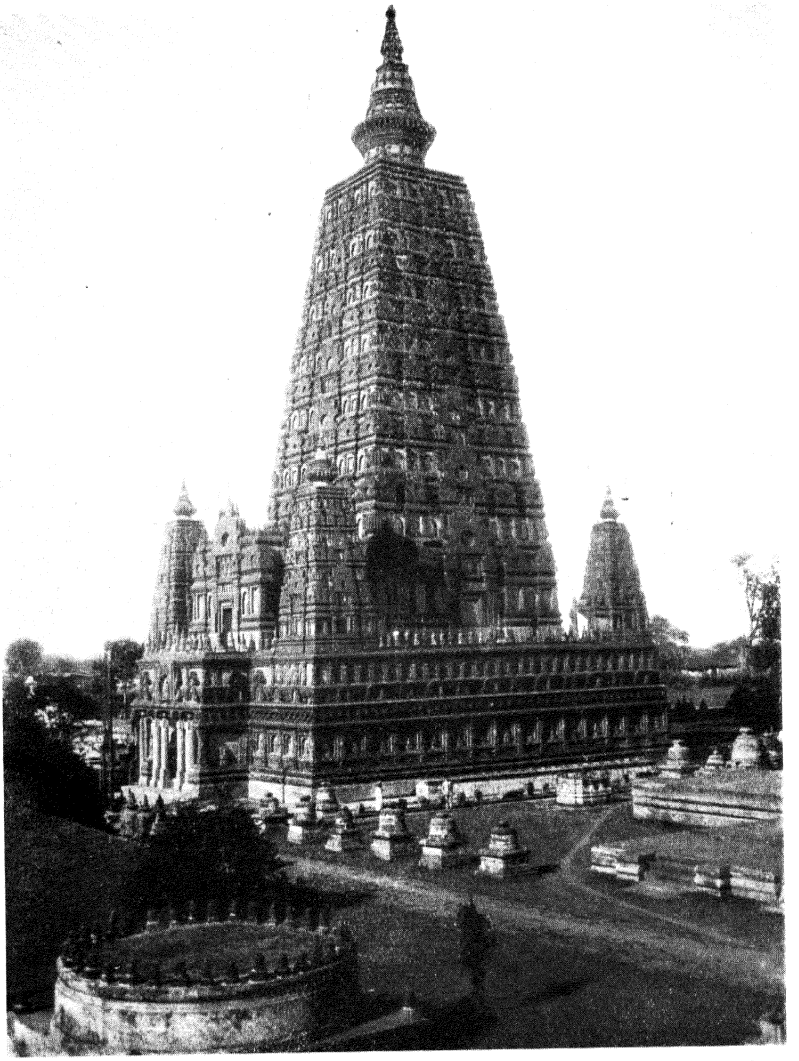


Photo. *E. N. S.*

TEMPLE OF BUDDH (BODH) GAYA, BIHAR, INDIA. A temple was erected on this site by the Emperor Asoka in the third century B.C. on the spot where Gautama Buddha received enlightenment while meditating under the sacred pipal or Bo-Tree. Later, the structure was replaced by another, which was restored in the eleventh century; and in 1882 to its present impressive form. A large gilded image of the Buddha, placed on an altar of the sanctum, is worshipped by the Hindu monks as an incarnation of Vishnu. (*See Chapter IX.*)

used directly upon the brain counteract the effects of shell-shock and similar psychological disturbances. This means that radiations artificially produced can influence the nerve-cells of the brain and therefore affect thought. Whether such waves capable of influencing human minds pervade the universe and can be picked up by receivers in harmony with them is an idea which brings physics into the realm of metaphysics or the philosophy of mind.

Cosmic rays of this kind are continually reaching the Earth and they have far greater penetrative power than X-rays and other radiations of extremely short wave-length. Their main source seems to be in parts of the universe far beyond the Milky Way, yet when they reach the Earth they possess their original energy-value and disintegrate countless millions of atoms of all substances, living and non-living, including those which make up the human body.

If these influences upon life had been known to primitive peoples they would have been worshipped like the Sun and other celestial objects as all-powerful deities. From the point of view of science they are natural forces to be studied without bringing in super-natural philosophy or endowing them with divine personalities. To suggest, as is often done, that the scientist or rationalist has banished heaven from his reckonings when he presents this attitude to the universe is to assert that the use of inquiry and reason in the search for truth in Nature is irreligious. The charge may be justified in the sense in which the physical forces which affect body and brain are not worshipped as gods, or sublimated in a single God, but given names not intended to be held sacred. The urge to inquire and discover may be described as due to divine grace or as a natural instinct, but the following of it cannot be regarded as a sign of man's impotence or of a lack of appreciation of external influences upon life in every form, whatever name or names is given to them or their Creator.

VIII

PRIMITIVE RELIGIOUS CULTS AND THEIR DEVELOPMENT

WHEN natural objects and phenomena, whether animate or inanimate, are believed to possess mystical powers which affect human life, they are treated with reverence and awe by primitive peoples and are regarded as sacred. The Sun and Moon, Light and Darkness, the Sky and Stars and the Earth commanded early attention in this sense, because they had certain permanent characters in space and followed fixed rules in time. Confidence in the unfailing aspects and influences of these visible things may be described as belief, and as faith when the object itself is given personality as a deity in which trust is placed.

At every stage of development of these ideas certain practices or rites are believed to provide contact with the sacred powers, whether these are material or not. In the higher religions, the unseen and incomprehensible influence becomes divine grace which can be approached by appropriate rituals and can be imparted to receptive minds. To professed Christians, faith is a saving grace which signifies communion with God and complete trust in the words and works of Jesus of Nazareth as recorded in the New Testament.

The exercise or practice of rites or observances connected with what is held to be sacred constitutes religious worship. It represents emotional reactions by psychic influences which may be vested in material objects or in abstract conceptions. Contact with these influences is as natural an experience as the incidence of rays of sunlight by the eye and their appreciation by the mind. While, however, the religious reaction is a part of man's nature, the modes of its expression take many forms, ranging from crude superstition to refined philosophy.

Theology includes the study of religious experience and its development, whether as related to sensory impressions or as insight into a realm of values beyond objective reality. As a science, it is concerned with all aspects and manifestations of religious faiths and their systematic formulation in doctrines and creeds. While, however, in the natural sciences a law or principle holds good only as long as no exceptions can be found to it, a creed in theology is taught as the final expression of truth, though its original words may be differently interpreted from time to time.

The history of most peoples affords evidence of belief in the existence of an omniscient and omnipotent power or influence behind the universe. If religion be understood in the broadest sense as belief in spiritual powers, it may be said that prolonged inquiry has failed to establish any clear instance of a people, however backward, who do not hold to a form of faith, which, though vague and rudimentary, can be deemed religious.

It is difficult to draw a hard and fast distinction between magic and religion; and, indeed, it is a question whether such a differentiation is essential from the point of view of the inquirer who is attempting to trace the development of the religious idea. For even "magic" implies some form of spiritual influence humanly directed. Belief in the efficacy of influencing the course of events by occult control of the mechanism of Nature is as much an act of faith in a form of spiritual action as Christian belief in divine intervention in human affairs; and the essence of a religious belief is an act of faith.

Faith may be defined as a belief which is not dependent upon material evidence or logical demonstration from premises ultimately based upon sensory phenomena (although such phenomena may be invoked to support faith as "proof"); but it acquires its validity from some general scheme or theory of the nature and purpose of "being", "life", "the universe", or, as the philosopher would say, of "the Absolute"; or, to use a popular phrase, "the scheme of things". In essence it is emotional instead of rational.

In its contact with "facts", faith interprets them not by observation and experiment (that is, by the approach of reason and science, which demand proof in the strict logical sense by reference to phenomena) but it evaluates them by the test of coherence with its theory of life and the universe. Such a scheme need not necessarily be consciously formulated or even realized as a whole. Probably, in the early phases of development, such realization rarely, if ever, takes place, as the minds of backward peoples work concretely and are averse from abstraction.

Whatever may be thought of evolutionary faith, evidence from comparative study shows that there is in the mentality of man a generalized urge towards a belief in spiritual values underlying the material appearances of the universe. This urge is fundamental. Various conditions, such as the influence of geographical and cultural environment, and possibly mental differences of racial strains, if there are such, have combined to produce the different types of belief and the religious systems which have been followed, or are now followed, by mankind. It is at least significant that, in the so-called primitive religions of the less advanced cultures, there

should be such strikingly close similarities in ritual and belief as have been recorded by the anthropologist.

Further, when we try to attain an objective view of the more advanced religions, it is no less striking that they fall into a more or less uniform pattern in regard to the relation of the three elements —tradition, ritual and ethics; in other words, in the relation of belief to worship and the conduct of life. Dissension arises not so much out of the nature of tradition as when interpretation is added to it and made a test of orthodoxy.

When there is a difference in the central objects of the various cults, opportunities for dissension are multiplied and reconciliation might seem well-nigh impossible. If, however, the spirit of religion is the manifestation of an elemental urge, recognition of this fundamental unity in man's emotional and spiritual nature should make possible a certain measure of co-operation on a common basis when the aim is the common good of mankind as a whole. As this religious sentiment—using the phrase in an ethical sense—exists in human nature, and is manifested in many ways, it has to be accounted for, and its evolution traced, by rational inquiries like those applied to other characteristics of life.

Evidence of the progressive development of forms of life in the past, and of changes still going on, is so convincing that it may almost be regarded as a law of Nature. In so far, therefore, as evolution signifies an orderly succession of organic growth, few would venture to deny the fact; but how and why such changes are brought about have not yet been established beyond discussion. The court of observational science is concerned only with evidence which throws light upon natural events, without assuming the existence of supernatural design or intervention. Whether behind the natural causes producing evolution there is a transcendental principle or architect is not the concern of naturalists but of other philosophers. The position is that even if the facts of organic evolution cannot be explained by existing knowledge, they will be understood when more is known about natural causes and consequences, without introducing a *deus ex machina* to conceal our ignorance and suppress the pursuit of objective evidence.

In the study of the evolution of religions, those types of belief in which the gods and divine beings are regarded as having human forms and feelings are described as man-like or anthropomorphic. The term anthropomorphism is, however, also applied to forms of belief which have not yet attained to this conception. In the minds of primitive peoples and of children all beings and things, animate and inanimate, are personified, and to them are attributed acts of will identical with those of man.

When once man has passed from what has been termed the "preanimistic" stage of belief (the stage in which he believed that everything around him, animate and inanimate and including himself, is endowed with mysterious and dangerous powers, a phase which belongs really to the magical level of thought) he enters into the animistic stage of belief, a belief in spirits. Not only does he believe in the existence of spirits, but judging from his own experience of dreams he comes to believe also in the possibility of the existence of a spirit apart from the object in which it normally resides.

Hence he attains to (1) belief in the existence of spirit after death, leading to funeral ritual, ancestor worship, and other forms of the cult of the dead; (2) the worship of spirits as such, apart from any material manifestation; and also to (3) the worship of the spirits which underlie the forces of Nature, whence arise cults of Sun, Moon and stars, fertility cults and the like, these objects and forces being personified as gods of earth, sky, sun, fertility, and so forth. Animals, also having souls, not unnaturally give rise to cults of fully-fledged gods in animal form, of which the personality is conceived in terms of the human, even though in outward aspect they may not conform to the requirements of the more restricted definition of anthropomorphism.

The earliest chronological stages in the development of primitive religious concepts are represented in the art of the age of Palaeolithic man about 30,000 years ago, as found mainly in Western Europe. In the caves of Southern France and Northern and Eastern Spain, on the walls and in the floor deposits belonging to this period, are found wall paintings and engravings, carvings on objects of bone and ivory, and sculptures in these materials, as well as in clay. These afford the earliest tangible evidence of the stirrings of the spirit in man's nature which was to act as his guide, both for good and for ill, in his upward progress towards the most advanced stages of development to which civilization has yet attained.

This must be admitted, however these manifestations of cultural development in prehistoric man are regarded. One view is that they are merely the satisfaction of an urge towards aesthetic expression. Another view is that early man, like his counterpart, the backward peoples of modern times, believed that, by the exercise of his ability to represent his desires in graphic form—in other words, to effect his purpose of controlling those forms of animal life upon which he depended for his food-supply—he was setting in motion forces more potent than his own to that end, and making of his painting and carving an act of magical invocation, or it may be even of religious observance.

Even if nothing more than a magical significance is attached to these realistic representations—cave-bear, mammoth or bull, the browsing deer, the vital energy of the galloping herd of horses, and the like—certain other examples of this artistic activity afford evidence of ideas which can be placed definitely within the category of religion, if only of a rudimentary type. Some such concept, for example, must be regarded as the explanation of the heads, inhuman in character, which crown otherwise human forms, posed in attitudes of supplication.

The more explicit figure of the "Sorcerer" of the cavern of Trois Frères, with its animal mask and tail, confirms the character of the more ambiguous figures, as representations of men masked to represent animals, which may, on the analogy of the practice of modern peoples, be construed as evidence of a conception of a spirit, even, say, a Divinity, in animal form. Trois Frères is in Ariège, France, and the cavern in which the drawing of the "Sorcerer", or medicine-man, appears contains a sort of pulpit. It was first described by Abbé Henri Breuil, the foremost living authority on the archaeology of the Old Stone Age, and Count Begouen, in the *Comptes rendus de l'Académie des Inscriptions* in 1920.

The cults of Early Man were, however, not confined to ceremonial concerned with spirits in animal form alone as represented in his art. There is evidence that some form of a cult of the dead was also practised. In the Neolithic age, about 10,000 years ago, as is well known from the evidence of human skeletal material which has been unearthed in archaeological excavations, interment was a ritual act. By its disposition of the limbs and of the body as a whole, the provision of grave goods—food, ornaments, weapons—and even, possibly, the sacrifice of slaves, certainly practised at a slightly later date, it gave expression to certain definite conceptions of the existence of a soul or spirit which survived physical death.

This spirit continued a form of existence in which, on proceeding in a direction indicated by the position of the body in the grave (that is, by its orientation to the rising or the setting Sun) it needed food for sustenance, weapons for its protection, ornaments as amulets to ward off evil influences, and, if human sacrifice had accompanied interment, slaves to minister to its needs.

Certain of these conceptions would seem to have been present to the mind of Palaeolithic man, at least in the later phases of his cultural development; for he practised interment; and the evidence of ornaments of shell, weapons and even, perhaps, of joints of meat, point to the cruder stages of the beliefs which by Neolithic times had developed into a substantive cult. Indeed, the wealth of the finds at

Predmost in Moravia, exceptional though they are, points to a cult even in Palaeolithic times which surpasses all in the abundance of its observance of the ritual, until we come to the type sites of the great early civilizations of the Near and Middle East.

When man had attained to the conception of a soul attached to the human body, but capable of a separate existence for a time after death (which is all that the evidence justifies) advance in other directions was, if not easy, at least viable. In early man's representations of animal forms in these paintings and engravings, it may be that ideas other than magical control were present to his mind, especially where he appears to lay emphasis on numbers, as, for example, in the herd of horses. It is possible that then his desire was to ensure and aid the fertility of his prey, as it is known that later peoples have desired to increase the fertility of the animals upon which they depended.

It may be said, therefore, that the evidence of the artistic activities of man in the Upper Palaeolithic age of about 20,000 years ago, and of certain practices in his disposal of the dead, justify the inference that there was within this period a progressive development in spiritual conceptions. In this development belief in the efficacy of a magical formula of graphic representation gives rise to faith in mimetic representation—as indicated in the masked figures and sexual images, which point to a fertility cult.

A further step is the fashioning of human female figures, possibly to be regarded as embodying divinity, on the analogy of ideas already made familiar in a primitive theory of the spirit or soul. This finds one form of expression in the cult of the dead, with its implication of mixed emotions of affection and fear, prompting man to make provision for the needs of the departed and at the same time to avert risk of the malice of their spirits.

How far such a progression may be said to come within the sphere of religion, even of a rudimentary type, must depend upon the point at which it is decided that the boundary line between magic and religion must be drawn. The question is not, perhaps, here of signal importance. The evidence is such that the distinction between spell and prayer, a crucial test, is hard to discern. Interest lies rather in the fact that we can in this material see the germs of ideas which at a more developed stage of culture have become definitely religious in character.

From preanimistic and animistic types of belief, stages of progress may be seen towards more definitely religious forms of approach to the unseen than appear in the magical spell that binds but does not supplicate. Even at the present time there are peoples who believe that men, animals, the heavenly bodies, atmospheric pheno-

mena and inanimate objects are all beings of the same structure. The Sun, Moon and stars, sky, Earth and sea, in all their phenomena and elements, as well as plants, animals and men, are supposed to belong to a system of conscious and interrelated life.

From such views it is not surprising to find the conceptions of divine individuality and higher powers emerging in due course. Among the Bushmen of South Africa there is a definite act of worship in the practice of praying to the Moon and other celestial bodies; but a certain confusion and interchangeability in their ideas is still to be seen in the conceptions embodied in the mythology, in which mythical beings appear having an animal form, and at the same time personify natural forces and bodies, such as the Moon and the like.

The association of totemism with the development of the idea of a personal deity is to be inferred from the character of myth on the north-west coast of America, where the totem animals, and especially the raven, appear to be taking on the character of culture-heroes. Stories of this type are very widespread in Africa, where animals, very often the mantis and the spider, shine as heroes remarkable for their success in getting the better of the other animals. The type is most familiar in the Uncle Remus stories, while other examples of the animal-hero story will be found in the folk-lore collected by the brothers Grimm. Except for outward form, the conception is entirely human and corresponds exactly in cultural setting with that of the people among whom the tale is current.

The particular interest of this class of tale is that it is a forerunner of the culture-hero in human form, of whom one of the best known among primitive peoples is Maui, the culture-hero of the Polynesian peoples, Maori and other, of the Pacific. The interest of the culture-hero is that he is very often regarded as the Creator, and not only endows men with the beginnings of his culture, but also is frequently the author of his being. Maui's part in creation was to create light by cutting apart his father and mother, sky and earth, who were previously joined together, thus letting in the light on his brothers and sisters, who lay between them. The land he fished up from the bottom of the sea by a rope and hook.

In Greek mythology, Deucalion and his wife Pyrrha recreated man, after Zeus had destroyed the world, by throwing stones over their shoulders, those thrown by Deucalion becoming men and those by Pyrrha women. Among the peoples of Africa there is a tradition of a creator-god, somewhat vaguely conceived and not frequently associated with the sky. But here it is usual that, after having performed his function of creating the world, he remains functionless and does not enter further into the religious system, as

among the Chinese, to whom the invisible power in the visible sky as an object of worship is taken by the ancestors.

In Greece, although Deucalion was the creator of man, according to one version, the function of culture-hero was also performed by Prometheus, who fashioned man from clay and gave him fire, for which he suffered the penalty of being bound to a rock while the vulture gnawed his vitals. This story evidently belonged to a strain other than the Deucalion legend.

Another famous culture-hero is Quetzalcoatl, the culture-god of the ancient Aztecs of Nahuatl. He was the god of the air, tall in stature, with a white skin, long dark hair and long beard. He lived for a time on the Earth, which during his stay teemed with fruit and flowers without cultivation, and a single ear of Indian corn was as much as a man could carry. He taught the Aztec the use of metals, agriculture and the arts of government. There are many examples of the view that, while animal cults and personification of natural forces as well as other influences have combined to mould the character of the culture-hero, in the main he must be regarded as a folk-memory of some half-forgotten, great, but human, benefactor of his people, in whom divinity has come to be personified as a wonder-worker and controller of magical forces, and hence a god.

While we thus see the culture-hero as having at least one strain of his ancestry in the animal cult, or legend, there are other directions in which that cult may develop. In view of the prominence of the animal myth among the Bushmen, where it is in cultural association with rock paintings and drawings of animals, for which a derivation has been suggested from prehistoric North Africa, it is of interest to note the prevalence of animal cults in Egypt, when it first emerges into the light of history.

At the time of the consolidation of the kingdom by Menes, the first king of the First Dynasty, Egypt consisted of a number of communities, or nomes, each of which appears to have had an animal form as its tutelary deity or standard. These animal forms, like the village deities in Hinduism, were subsumed into the official pantheon. As they are known to us in the representations of the Egyptian deities in art of the animal form, only the animal head remains, and the body is human. Thus we get the hawk—the symbol of royalty—the bull, the cow, the hippopotamus, the jackal, the ibis, and the like.

It has been suggested that these animals were originally the totems of the groups from which the nomes were formed, but there is little evidence to support this view. The association with matriarchy in the royal line is explicable on other grounds. The point of

interest is that here we have an animal cult caught and fixed at a moment when it was about to impose full human form on the objects of its worship. The religious beliefs of Egypt were fully as composite in character as the religion of Rome. Apis the bull (or Mnevis) and Hathor the cow were also part of a fertility cult. That this fertility cult had taken the place in dynastic importance of the more primitive animal cult is indicated by the identification of the monarch with the bull in an annual festival, in which the ruler had to sacrifice the animal which he also represented.

The importance of such a cult and ceremonial to an agricultural people like the Egyptians is obvious; and this is marked further by the persistence of the elements of the cult in the official religion through Egyptian history, though often with much modification. One of the earliest modifying influences affecting the Horus or hawk cult was the appearance at about the Fifth Dynasty (2750 B.C.) of the worship of the Sun as the deity Ra, or Amon. Horus is then identified with the Sun, the king is Ra the Sun, and the son of the Sun. That this was a physical fact as well as a theological dogma was part of Egyptian official belief. Hathor, the cow, also shows evidence of modification, by identification with the Moon-goddess, as she continues to be in later manifestation, when she is identified with Isis, who in her turn takes on Hathor's incarnation as the cow-goddess.

It is an interesting point in this connection that where, as among the peoples of Africa, the deification of natural forces such as Sun and Moon takes place, and supplications for rain are addressed to them, as among the Bushmen, Hottentots and Bantu of South Africa, the home of the gods—heaven so to speak—is in the sky. Among the Egyptians, to whom fertility came not from rain (which is of such signal moment in an arid country) but from the inundation of the Nile, the home of divinity and the place of the judging of the dead is underground and is reached by a subterranean river.

The Sun cult remained the predominant belief in one form or another—for it was not entirely unchanged—until a late phase in Egyptian history, the king being the incarnation of Amon, Ra and Horus, the Sun and hawk gods on Earth, in one personality. Cleopatra as a queen appears as Isis with her son Horus, the fertility cult having resumed importance with the introduction of Isis worship from Syria. Another important influence affecting the Sun cult, though only temporarily, was the disk worship introduced by Ikhnaton, in all probability, like the Isis cult, also from Asia.

Sun and Moon cults were also of great importance in early Sumeria, where appears a culture-hero Marduk or Shamash as the

creator, the hero who fights with the dragon and the founder of Sumerian cultural organization. From this source come a number of conceptions which have proved of signal importance in the world's history. The harsh character of climatic conditions in the Middle East, Mesopotamia and Iran had an evident influence on the character of their religions. In Mesopotamia, especially in the time of Assyrian domination, belief in evil spirits plays a great part, and even the character of individual gods—this is apparent as early as Sumerian times—is often a curious compound of both evil and good qualities.

The contrast between good and evil in divinity is manifested also in the beliefs of Iran in the dualism characteristic in the two spirits of Good and Evil—Ormuzd and Ahriman—and in the tenets of Zoroastrianism. The contrast is one between the desert and the sown. The desert as the haunt of evil spirits appears in the Bible; for example, in the Temptations in the Wilderness, and in the beliefs of Islam in which the desert is one of the homes of the evil djinn. It is a personification of natural conditions hostile to human life, and consequently an object of fear.

This belief in the dualistic strain in spirit is responsible for the story of the angels who rebelled against God and fell, and also of the Christian concept of a personal devil. The original Mesopotamian evil spirits to which belief can be traced belong, however, to the order of horrible monsters, while for the popular idea of the Devil we must go to the Greek belief, in which he appears as the Great God Pan, the god half-man and half-goat with the cloven hoof, which always betrays our Devil, whatever shape he may assume.

The form of the god Pan, and the goat-like characters of the fauns and other sylvan deities of Greece, indicate that the animal cult of the ancient world was not confined to Egypt. In ancient Rome a memory of it appears in the story of Romulus and Remus being suckled by the wolf; while in Greece it survives in the stories of the incarnation of Zeus and other gods in animal form in pursuit of amorous adventure; for example, the story of Leda (beloved by Zeus in the form of a swan), Pasiphae, wife of Minos, King of Crete, who became enamoured of a white bull, of which the Minotaur was the offspring, and so forth.

There are other examples of personification of natural forces, and especially of the divinity of the sky as the source of rain. In Uganda, it is recorded, the people worshipped ancestral and nature spirits which were elevated into gods and goddesses. The worship of some such spiritual form, which is elevated into a divinity of the sky appears to have been the earliest form of belief in China of which

there is evidence. The symbol for the divinity of the sky in the earliest hieroglyphs, which are now usually attributed to somewhere about the seventeenth century B.C., or it may be earlier, is something which is usually interpreted as the outline of the human form. If this be correct, China would appear, in the earliest stages of belief of which there is record, to have held the creed of a sky-god monotheism. From this, however, she fell away into materialism and spiritism, with ancestor cults as the popular form of belief.

In Japan, on the other hand, in the culture derived from China and preceding the introduction of Buddhism, divinity was conceived in the form of a female Sun-god, who was the ruler of the land. The first human ruler was the grandson of this goddess, and from him is descended the line of emperors. Hence the divine character of the Mikado or Sovereign, with the consequent necessity for securing his consent when it is desired to introduce reforms or changes in the domestic or military organization of the country.

The cult of the ancestral spirits has in all probability played a powerful part in the development of the anthropomorphic idea. It is believed by Australian aborigines that conception which leads to birth arises from the entry of a spirit into the body of a woman without the intervention of the male. It is this idea of reincarnation which lies at the root of the ancestral cult as it is practised, for example, in Africa among the Bantu peoples; the development of the concept depending also upon the widespread cult of the dead. Further, as the place is haunted by the spirits, their abode is especially sacred, and so it gives rise to such forms of worship as the tree cults, in which, notwithstanding appearances, it is the ancestral spirit and not the tree itself which is the object of the cult.

Ancestor worship is, in strict fact, a matter of family observance; but as the tribal chief is in some measure responsible for the well-being of the whole group, village, tribe, or whatever it may be, as well as for his immediate family, it is customary for his own ancestors to be made the subjects of ritual approach on such occasions as may affect the well-being of the whole group: for example, when in need of rain. That an ancestor of especial importance or power might assume the character of a culture-hero, and ultimately of a deity, is an obvious development.

The influence of the emperors of China resided in the fact that they had access to the royal ancestors, who were looked upon as the protectors of the whole country and its people, just as the ancestors of ordinary folk looked after the needs and protected the members of their own family, when the rites of ancestor worship were duly

observed. Investigations in a number of areas, and among different races, afford evidence that the first spirits to be personified and deified were those o ancestors. Memories of leaders who were greatly loved and honoured during life may easily pass into reverence and worship of their spirits.

Turning to America, the pantheon of the ancient Aztecs represents what is perhaps the most highly developed system of an anthropomorphic worship to be found on that continent; and, what is more, one that is closely, though not exclusively, connected with the development of the idea of the divinity of natural forces and the sky. The Aztec system, which was associated with some of the most atrocious practices of sacrifice that the world has ever seen, was imposed upon a much milder form of religious belief, that of the Mayas, which was largely concerned with deities associated with the practice of agriculture and of which the rites were mainly directed to secure fertility.

The origin of the Aztec system is probably from some such source as that from which the modern cults of the Indian of the south-western states are derived. In these cults the forces of Nature are worshipped, but significantly the various quarters of the sky play a great part. Among the Hopi of Arizona, the snake dance, in which the sky divinity is evidently personified, has attracted much attention and is now a tourist attraction; while, among the Arapaho, in the decorative designs with which they ornament their leather parfleches and other objects of use, both the geometric designs and the colours have significance as symbolizing the lightning, the cardinal points, and matters of a like character.

Behind all this symbolism is divinity personified as immanent in these forces and elements. It was from such ideas that the Aztecs appear to have elaborated a system of Nature and sky deities, of which one—a goddess—was in charge of rain, another of fire, thunder, and so forth. The same personification of points of the compass in the form of deity appears to persist among the Mexican peasant population today, largely Indian in blood. The patron deity of the country, among the Aztecs, if we are to trust the usual interpretation of his name, was associated with the humming bird. This was Uitzilopochtli, the god of war, who was depicted as a man having the feathers of the humming-bird on his left foot, and that being the meaning of his name; while Quetzalcoatl, the culture deity and god of the corn, is "the feathered serpent", a frequent and significant fertility symbol still in use among the Indians of the south-west.

The elaborate anthropomorphic system encountered in Central America finds its counterpart in the religious systems of the Old

World, not only in ancient Egypt but even more in the pantheons of the Aryan-speaking peoples of the dawn of history. These have had an incalculable effect on the development of civilization and the cultural character of modern Europe. These anthropomorphic cults are a formidable array—the religious system which the Arya introduced into India, which after amalgamation (not admitted by the Hindus) with previously existing cults developed into Hinduism; the religion of Iran, to which the Aryan religion was closely related; the beliefs of the kingdom of Mitanni and, in part, probably of the Hittites; the religions of ancient Greece, Rome, and of the Teutonic and Slav peoples, who overran Central Europe, and peopled Scandinavia, and of the Celtic peoples who from Central Europe came to Gaul and finally reached Great Britain and Ireland.

Ultimately, as can be seen perhaps most clearly in the deities of India, and in the thunderbolt of Zeus in Greece, these divinities were the personification in human form of the forces of Nature, the sky, the Earth, the sea, the Sun, Moon, fire, and so forth. Each god was departmentalized and had a special province, at least in the most highly developed form in Greece, where, when they amalgamated with local cults, each took on special characteristics; for example, in the association of Zeus with the oracle of Dodona and of Phoebus (Apollo) at Delphi. Of the influence of these conceptions on the anthropomorphic idea the art of Greece speaks more eloquently than words. This is especially to be noted in regard to the divine in relation to the female form, for with each of the principal male deities a female consort was associated—Hera, Athena, Artemis, Aphrodite and the like—just as with Vishnu and other manifestations of deity in India.

The cult of the mother-goddess, in its various localized forms, and especially on its more tender and maternal side (which finds extreme expression in artistic representation as the many-breasted Greek goddess Artemis) had a profound effect on the development of religious thought in the Mediterranean and Near East. It was, in fact, the popular religion, and in Greece, it is permissible to suggest, the contrast of this and other fertility cults with the official pantheon of sky-gods, which had been introduced into the Mediterranean world by the invaders from the north, may have had no little influence in bringing about a play of ideas which led to the scepticism of Greek philosophy, when face to face with the official religion. This gave rise to the criticism of anthropomorphic forms of belief of Xenophanes, when he remarked that had horses, lions and other animals gods, they, too, would be such animals. The cult of the mother-goddess was no doubt largely responsible for the cult of the Madonna in the early Christian Church.

It should always be remembered that the Christian Church was in its origin an eastern institution, which grew up among pagan peoples habituated to the idea of female divinity; and the cult appears in Church doctrine at a time when the incorporation of pagan peoples in the Church body was bringing about the admission into its doctrine of tenets of pagan origin which were averse from the strict interpretation of Christian theology. There can be little question that the cult of the Madonna was in some measure responsible for the conflict between the north and the south, of which the final effect was the Reformation. This was a cultural as much as a religious conflict, in which on one side was a long tradition reaching back to a cult of female divinity; on the other, in the north, an almost equally long tradition of the worship of a sky-god as supreme—an all-powerful divine father and ruler.

The same division of religious belief—broadly still a cultural division of north and south, although both Churches are in name Christian—persists in the refusal of Roman Catholics and Protestants each to give really serious consideration to the theology of the rival system. The differences are due largely to different reactions to religious emotions among peoples of the north and south. From the evidence to be deduced from the beliefs of primitive peoples and the historical records of early forms of religion, it appears that development is analogous to the evolution of racial strains.

There are now no pure races; because of human evolution there has been a constant intermingling and crossing which has made of present-day peoples a highly complex racial admixture. In the same way, in considering the development of religious cults, there does not appear to emerge any single line of development; but there has been a constant intermingling and cultural contact, which has produced forms showing traces of the influence of now magical ideas, now spirit cults, ancestor worship, and many other forms and shades of belief.

The religion of the Roman empire was a remarkable example of such a composite produce. While the official religion was in the main a system of sky-gods, such as was common to all the Aryan-speaking peoples, it had been to no little extent remodelled on the lines of the Greek official pantheon. At the same time it included at one end of the scale the deification of the living emperor, and at the other primitive agricultural fertility cults retained side by side with the family and household gods, and the cult of the hearth which belonged properly to the Aryan-speaking tribes and their primitive patriarchal system of organization. To these must be added the typically Mediterranean cult of *Bona Dea*, as well as a system of reverence for the family or group ancestors, which in



Photo. *E. N. S.*

THE TEMPLE OF HEAVEN, PEKING, built on the orders of Yung Lo (1403–1425 A.D.) of the Ming Dynasty. The temple is not a shrine to Confucius, but a place where the Emperor reported alone annually, at the Winter Solstice, to the spirits of his ancestors on the state of the nation, and implored Heaven to grant good crops and the protection of his people. The temple is surrounded by tiers of marble seats with elaborately carved backs, where the Ministers of State and palace attendants awaited the return of the Emperor from his lonely pilgrimage of intercession. (*See Chapter IX.*

certain respects resembles the ancestral cult of China. Further, to the indigenous Roman system of religion was added a number of exotic cults brought to Rome as a result of the conquests of eastern and other peoples, among which the cult of Isis from Egypt is the best known and was the most popular.

IX

SACRED BOOKS AND BELIEFS

THE history of doctrine is recorded in the sacred books of religion, and it shows the various forms in which the religious emotions of men have clothed themselves and the various dogmas into which they have been crystallized. In the study of comparative religions the Bible takes its place among other sacred texts which gradually become canons of orthodoxy and are assumed to constitute an infallible and authoritative text-book of life and morals, law and learning. Doctrine must, however, necessarily develop with knowledge and enlightenment, as the mind of man gains new ideas and new points of view in conflict with the uncompromising attitudes of protectors from attrition of the creeds of past generations.

In every system of religion, whether primitive or advanced, provided it is a natural growth and not a "forced" and self-conscious product of sophisticated intellect or emotion, three elements can be distinguished.

First, there is a body of legend or traditional lore, which commonly will be found to include material indicating directly, or indirectly, the conceptions currently held of the nature and attributes of the external or superhuman forces of the universe—spirits, deity or deities; a story of creation, more or less comprehensive and usually covering the creation of mankind; exemplifications of the relations of mankind to gods, spirits and the animate and inanimate world ("inanimate" here in the modern sense, as to the primitive mind all things were animate); the origins, migrations and traditional history of the people, whose faith and beliefs, or knowledge, as they regard it, are set out herein; and so forth. From this and such material are elaborated, more or less complete, the various systems of theology.



Photo. *E. N. S.*

GENERAL VIEW OF CAIRO, showing the mosque of Sultan Hassan, erected in the fourteenth century in the Mameluke style typical of other mosques in Cairo, Damascus and elsewhere. The Mamelukes were a military class originally composed of Circassian slaves. (*See Chapter IX.*)

Secondly, there is the ritual or order of worship, which prescribes the mode of approach to the spirits, deities or deity, on set or incidental occasions, in order to propitiate, serve, adore, or enter into communion with them. The purpose of this ritual may range from the simple or primitive objective of preventing or averting the influence of the spirits, which is believed to be harmful, unless they are propitiated, or of constraining them by some magical or ceremonial act to serve the votary, to some such object as that of an advanced type of belief, which aims at securing the benevolent guidance and favour of an all-seeing and all-powerful ruler of the universe; or aims, in certain eastern systems of thought, at attaining complete at-oneness with the universal principle of being. Ritual is either based upon the body of sacred tradition or can be justified by reference to, or interpretation of, that body of tradition. Such is, for example, the justification in theory of the rituals of the various Protestant Churches, the Roman Church, and the Orthodox Churches, each differing, however, in interpretation of and in faithfulness to what is regarded as the practice of the early Church.

Very often it is found that the tradition has been framed to account for the ritual, of which the original meaning has been lost or obscured; for example, the Adonis and Iris and Osiris legends grew up around the ritual to explain a human sacrifice to promote fertility. It is for this reason that the explanations given to anthropologists by native informants rarely go back to the original and true purpose of a rite.

Thirdly, there is a system of ethic or rules of conduct by observance of which conduct in life is brought into harmony with cosmic principles. Of such systems the following may be regarded as a grouping of some of the most strongly marked types.

(*a*) In the primitive forms of religion, by observance of such rules or precepts, men avoid actions which would be followed by spiritual intervention of a harmful character, possibly affecting not only the individual alone, but also his family, or even the community as a whole. This is the system of tabu, of which infringement (such as, for example, by touching the person or regalia of a chief in Polynesia or the Malay Peninsula) may be followed by a disease affecting the individual only. Or it may entail, as sometimes in the instances of adultery or incest, the failure of the crops of the whole country. This system of tabu is the germ from which develop the codes of ethics governing personal and social relations, although, naturally, as these codes advance in complexity, factors other than the magical or spiritual forces in the background of tabu come into operation.

(*b*) In more advanced forms of religion men may impose upon

themselves adherence to a formal code of ceremonial regulations with a view to maintain their ceremonial cleanness or preserving themselves from ceremonial uncleanness. This may give rise to a conception of purity and impurity, as the basis of the ethical code, which is very little removed from the idea of physical or material pollution; but it may also lead to advanced spiritual conceptions. In either event there is a formalism of thought and conduct, which in practice and ideas differs little from the ritualism of worship already mentioned. It was such an extreme form of ritualism in conduct as this which Christ had in mind in rebuking the Pharisees; and it is to be observed to-day in some of the more extreme rules of caste (Brahmanism) in India.

(*c*) The highest form of religious ethic is that in which the aim of conduct is complete and implicit obedience to what is conceived to be the Will of God. In its less generous manifestations this obedience may be rendered against natural inclination as an outcome of fear; for "The fear of the Lord is the beginning of wisdom". It may then degenerate into a formalism as lifeless as, and even more harsh than, that of those systems which stress ceremonial purity. On the other hand, it may become a joyous and spontaneous acceptance of a mode of life, such as it is conceived would be consonant with the nature of God, subject to such limitations of the flesh as are ineradicable—the ideal of saintliness. Hence arises the desire for uprightness as an end in itself, either with a view to reward, if not in this world, in the next, or pursued selflessly for its own sake. This concept of religious ethic has led to the highest idealism in human conduct; but it has also degenerated into many unpleasant forms of exaggerated and distorted continence and self-torture in the monastic, ascetic and mystic conceptions of the holy life.

The aberrations of religious systems of ethics, or rather of their more fanatical followers and exponents, have been pursued in face of the exemplars they had before them, in some instances at least, in the lives and teaching of their founders; for example, Christ, Gautama Buddha, and Confucius. These exemplified a practical morality, which, had it been adopted by those who came after them, might have served the needs of a united mankind—united, that is, in all that is essential in making for well-doing and well-being. Such ideal systems, however, it is said, were not adaptable to the conditions of a workaday world. But this is true of every measure of reform, and constitutes the justification of its claim to the title of "reform"; while its success lies in the fact that it has forced everyday conditions to comply with its demands, and not that it had adapted itself to them.

Study of the relations of the three elements or facets, as outlined

above, in the religious systems of past and present, is no mere work of supererogation. For out of these relations there has grown the strife and disunion, which, as Christ foresaw of His own teaching, have been an inseparable accompaniment of intensity in religious belief. Conflict arises especially out of the resulting concepts of divinity and spirit which have been presented to the minds of men in the various systems of theology evolved from what has here been called tradition—in no invidious sense—and the relation of those systems to the practice and theory of conduct in life to be required of those who actually do, or are expected to, accept them. Some idea of how this has come about may perhaps be gathered from a brief consideration of the character and history of the mode of presentation of these three elements in the religious systems of the world to their followers, and the authority upon which they base their claim to unqualified acceptance.

When Moses, as we are told, came down from Sinai, bearing the Tables of the Law which he had received from the hand of God, there began a tradition of the Divine origin of the Scriptures and of their inerrancy as the Word of God delivered through men who were divinely inspired, but as such were no more than His instruments. This view of the Law and the prophets was accepted from the Jews by the earliest Christians, themselves Jews, and transmitted by them to the Gentiles. Among the Gentiles the tradition, which now included the books of the New Testament, descended from generation to generation, though subjected to a growing scepticism. This scepticism appeared as early as the centuries immediately following the first expansion of Christianity, and, gathering strength from the days of Galileo and Copernicus, finally dethroned the Bible from its position of unquestionable authority in the late nineteenth and early twentieth centuries.

There has thus been brought together in the last two generations a large and still steadily increasing body of evidence by which a considerable and influential proportion of the Christian world has been led to the conclusion that a modification in the attitude of the Churches towards the Bible, as the sacred book of the Christian religion, is inevitable. This conclusion can scarcely be avoided in the light of the developments in scientific knowledge and biblical scholarship since the middle of the last century.

As one of the earliest results of the application of the comparative method of study to the Bible it was apparent that its position as a body of sacred literature was by no means unique. The initial difficulty of such studies in the nineteenth century was, of course, to eliminate the idea that, Christianity being regarded as the only true religion, all other systems were mere superstition. When once

this prejudice is overcome, it is possible to show that every form of religion (as already indicated) is based upon a body of tradition, sometimes, but not in all instances, embodied in written documents, which stands in an analogous relation to their particular creed as the Bible to the dogma, ritual and ethical system of Christianity.

When once this objective point of view is attained, it is possible to grasp that even so primitive a culture as that of the Australian aborigines, who apart from their European contacts are a people of the Stone Age, has a body of tradition which has a direct bearing upon tribal custom, social organization and behaviour; at the same time, at least in part, it is of so sacred a character that it must not be revealed to women or to those males of the tribe who have not yet been admitted into full membership. This sacred tradition deals with the Golden Age of the past, the Alcheringa, when communion of spirits and men was closer than now; but it also deals with the ceremonial in which the bull-roarer embodies the voice of the god. When it sounds it strikes terror into the hearts of the tribe, and its nature must never be revealed to women. In this same ceremonial of initiation the novice is instructed in his rights and more especially in his duties as a full member of the tribe.

Whether Darumulun was a high god, or merely the bull-roarer, an ancient and sacred but obviously man-made piece of wood—a subject of acute controversy a generation ago—is immaterial. This ceremonial would not be interpreted as a mere piece of "mumbo-jumbo", a conscious deception on the part of the elders of the tribe, as some would have maintained formerly, but as a solemn ceremonial in full accord with the concepts of a primitive mentality, which would recognize divinity embodied in the meanest object. The important issue for the present purpose is that this ceremonial embodies in concrete form (*a*) the tradition ("scripture"), (*b*) the ritual and (*c*) the ethical code as parts of a religious system in which, however crude and rudimentary it may be, the second and third elements stand in the same relation to the first as the analogous elements do in the tradition of the Christian system.

It would be possible to multiply parallel examples almost indefinitely, more especially from the interesting initiation ceremonies of the tribes and secret societies of Africa, in which, in addition to the ethical instruction, the theological concept of death and resurrection is exemplified in the ceremonial which the novices undergo. One of the most instructive groups of legend and doctrine is that of the Pacific peoples which centres in the person of the divine culture-hero Maui.

The interest of this body of legend lies in its development, with

other elements of tradition, into a body of esoteric doctrine among the Maori, who for more than six hundred years have preserved a detailed record of the voyage of their ancestors across fourteen hundred miles of sea to New Zealand, and of the canoes in which they came. Of this esoteric knowledge the priesthood was the repository. Prolonged instruction in its tenets was an essential preparation for attainment to that office.

These few examples must suffice to demonstrate that "literature" —to use an incorrect but convenient term—which may be regarded as sacred, is a possession common to primitive peoples generally. If it is accepted that such a construction is not without foundation in the evidence cited, it is unnecessary to call in the aid of a special dispensation to account for the appearance of such a literature among a primitive nomadic people, as the Hebrews were when first they appear on the scene of history; that is, as now generally accepted, in the days of Abraham, about 2000 B.C. or possibly a little earlier.

In general outline, notwithstanding cultural differences, there is no little resemblance between the Hebrews and the peoples of India in respect of their sacred literature and their religious history. In both Palestine and India, tradition takes its origin from the legendary lore of a nomadic pastoral people, whose beliefs become the basis of a religious system, which eventually is dominated and formalized by a priesthood. This formalized religion is regenerated and recast by a religious reformer: in Palestine, Christ; in India, Gautama Buddha, whose teaching and ethical code transcend the boundaries of the respective countries of their origin and attain something in the nature of a form of belief capable of universal appeal.

The resemblance must not be pressed too hard; but it is at least a remarkable coincidence that both Buddhism and Christianity failed to maintain their foothold among the peoples with whom they originated, and now number only "gentiles" among their adherents. There is a further point of resemblance in the history of Jewry and Hinduism, that in both a priestly revival followed a period of crisis: in Palestine it was post-exile; in India, the neo-Brahmanism which followed the decay of Buddhism in the early centuries of the Christian era.

The sacred literature of India will always rank among the great literatures of the world. Like the Bible it comprises a number of documents of widely varied age and character. Of these the earliest are the Vedas, which embody the religious and cosmic concepts of the invading Arya, who entered India probably not later than the middle of the second millennium B.C., or some tribes possibly a

few centuries earlier. These concepts personify the forces of Nature as divine and spiritual beings, often inverting their original attributes as they appear in the earlier Iranian *Zend Avesta*, to which the Vedic hymns are obviously closely related.

The Vedic hymns and early Brahmanic writings constitute the "classics" of Indian literature, and their interest for modern Hinduism is historical as bearing on origins, rather than directly doctrinal and ritualistic. This character belongs more strictly to the later writings, which developed from them. With the rise of the Brahmans, the priestly class, into power, an event which may be placed at somewhere in the neighbourhood of 800 B.C., there began a systemization and formalization of the beliefs in personified natural forces of the Vedas which was finally carried as far as the creation of an organized polytheism or pantheon. With this development of religious belief there was also built up a highly developed and formalized body of ritual and ceremonial, which was closely associated with the elaboration of the caste system, in which the Brahman is supreme. This took the place of the form of society with which the Vedas are to be associated—a society in which the predominant class is the warrior, the Kshattriya.

Although the rise of the Brahman to ascendancy has been much obscured, especially by speculation of a theological, social and political trend among the Hindus, and although the origin of caste is a matter of controversy which seems to offer little prospect of satisfactory solution, it is tempting to regard the predominance of the Brahman in this early period as the final stage of the submergence of an invading culture by the indigenous civilization—as has happened in the history of the world time and again—as well as a mark of that reverence for the gods of the soil which is a characteristic of the spread of Hinduism among the aboriginal peoples to this day.

Be that as it may, it is certain that with the rise of Brahmanism there set in a period of formalism in Indian life and belief which finally attained a point where opposition became widespread and numerous movements towards reform came into being. Of these the most important was Buddhism, the teaching and doctrine of Gautama, which appears in the sixth century B.C., the latest of the dates recorded for the death of the founder being 488 B.C. The teaching of Buddha offered to his followers the ethical doctrine of salvation through a new way of life, in place of a conformity, empty of content, to an elaborate ritual and ceremonial sterilizing every relation with gods and men.

Apart from the ethical teaching of Buddha, which naturally affected the attitude of his followers towards the social system of the

Brahmans, with its observance of the caste theory, theologically and philosophically the trend of Buddhistic thought was in opposition to Brahmanic doctrine. The trend of development in Indian thought was moving steadily towards a pantheistic philosophy. In the Upanishads, the latest development of the Vedic writings, there can be discerned the beginnings of this movement in the search for a single reality behind the individual gods, and for salvation, not in the performance of ceremonies, but in the attainment of unity with this reality in a universe having no beginning or end yet continually growing and decaying, like all forms of life within it.

The conception of a single principle or entity behind the personalities of the gods represented an early endeavour on the part of India to solve the philosophic problem of the one and the many which was the preoccupation of Greek philosophy and thence descended to modern philosophy. Buddhism was only one among a number of voices uttering a protest against the formalism of the Brahmans, and seeking to revert to the position of the Vedas, as thus interpreted. It denied the existence of any permanent substratum in this world.

This Vedanta Philosophy, which is the common basis of India's many sects, has evolved from the teaching of the Vedas and now represents what is usually called Hinduism. It teaches the essential unity of all religions, and its enlightened message is being spread through the world by highly cultured missionaries belonging to the Ramakrishna Order of India. A Swami is a monk and a religious teacher of this Order.

With the rise of Buddhism in Northern India, the doctrines of the Brahmans suffered a complete eclipse. This was largely owing to the fact that Buddhism was embraced by a succession of powerful monarchs, of whom Asoka, the great Indian emperor (264–228 B.C.), is the best known. His missionaries spread the doctrines of Buddhism far beyond the confines of India. Passing first to the south of the sub-continent, thence it reached Ceylon, and from there it went on to Further India, and ultimately to Malaya, Java Sumatra and other islands of Indonesia. In the north it travelled to the north-west in the direction of what is now Afghanistan, where a powerful school took shape in the kingdom of Gandhara, and entered Tibet. From the Indian borderlands it overran the lands of what is now the central Asiatic desert, reaching China (where for a considerable period it was the predominant religion), Korea, and ultimately Japan.

It is a significant fact that the principal source of intimate knowledge of the status and character of Buddhism in India in its later period (that is, from the third to the seventh and eighth centur-

ies A.D.), is based upon the accounts of the Chinese Buddhist pilgrims who visited India and its principal Buddhist shrines and centres of teaching, in order to learn the true precepts of the faith, which in China in course of transmission over a long period of time had become corrupt.

This is an interesting fact, which should be kept in mind in considering the character of Buddhism in relation to its wide geographical distribution and influence. Taken over this vast expanse of its geographical distribution, the character of Buddhism is not uniform. In each country to which it spread, however much its adherents may have professed and tried to keep the doctrine pure, in actual practice (as happened with other religions which have been widely propagated by missionary effort) doctrines to some extent have been modified to conform to local religious beliefs.

Thus, in Tibet, Buddhism is a very different thing from Buddhism in India, more especially in respect of the numerous incarnations of Buddha, the bodhisattvas, which virtually have been elevated into separate deities; while the so-called devil worship, that is, shamanism, of Tibet has been freely incorporated into belief and ritual.

In Further India, the period of the efflorescence of the arts of architecture and sculpture most characteristic of the best Buddhist period is regarded as culminating in the great temples, of which the best known is Ankor Vat (A.D. 1125) in Cambodia, French Indo-China. In these temples, the concepts of Hinduism and Hindu art (it is scarcely necessary to recall that this is a great and exclusively religious art) are inextricably mingled with the forms and concepts of Buddhism, and a like confusion of diverse elements is to be found in the legendary and traditional lore which is its inseparable accompaniment.

With the decline of Buddhism, which began soon after the second century A.D. and was practically complete, at least in a political sense, by the fifth century A.D., Brahmanism again raised its head. For modern Hinduism this period of neo-Brahmanism is the most important. It is then that the sacred literature of Hinduism takes its shape; and it is especially significant in its relation to early tradition, as in the *Puranas* scriptures where the theological and philosophic arguments were directed to show that there had been no break in continuity between the Vedas and Brahmanism.

It is also in this body of literature that there are included the *Mahabharata* and the *Ramayana*, the two great sacred epics of India, in which are gathered up and brought together a vast collection of beliefs, legends and folk-lore which had been current in India from the earliest times. To these must be added the important sacred

Code of Manu, a document which deals with the religious, ritualistic and social life of Hinduism in minute detail. For general guidance and for matters in dispute in the conduct of every department of life, from small to great, reference to these documents is the supreme authority; but as with other great bodies of sacred literature, interpretation has given rise to a number of sects into which Hinduism is still divided to-day.

The same remark as to the existence of sects of diverse views might also be applied to Buddhism—apart from the differences of national and geographical distribution to which reference has already been made. In the accounts of the voyages of the Chinese pilgrims, even when Buddhism was on the decline, it is recorded that there were no less than eighteen different Buddhist sects in India. The differences between the Buddhist sects were not all differences of doctrinal interpretation. Some were due to differences of memory. There are no Buddhist documents contemporary with the rise of the faith in Buddha's teaching, and the record is derived from posthumous memory. The number of documents purporting to contain the authentic record is large. Of these the most comprehensive is that of "The School of the Elders" in Pali, the canon of the Theravadins of Ceylon, where Buddhism was introduced by missionaries in the third century B.C.

Among the older schools the canon exists in the threefold division of the Tri-pitaka which was settled, with the orthodox commentaries, at the Council of Gandhara summoned by Kanishka, ruler of Gandhara, in the first century A.D., and afterwards reduced to writing. The Tri-pitaka, or "Three-fold Basket", contains in its three divisions rules of discipline (227 in number) binding on the monks, with a commentary, which is also regarded as canonical, and five collections of discourses attributed to Buddha. The Jataka, the most important of the discourses, because of the information relating to Buddha which it contains, is not, however, canonical. This collection includes "Material relating to Buddha's Previous Births", or incarnation before Gautama.

The most important sectarian division in Buddhism, however, is that between the followers of the Mahayana, the doctrine of the Greater Vehicle, and that of the Hinayana, the Lesser Vehicle. Broadly speaking, the former covers the schools of northern Buddhism, which spread out over Central Asia to China, and the latter those of Southern India, and their converts in Further India.

It will be seen that Buddhism is in no inferior position in comparison with other faiths in the possession of a large body of sacred literature, in which are contained historic narratives relating to the founder, who is virtually elevated to the position of divinity. This is

true also of the exposition of the theological and philosophical doctrine which is said to be his teaching, and the code of ethics which he inculcated. The relation of this literature to Buddhism generally is not so much that of the Bible to Christianity, although analogous, but rather as if each of the Gospels, instead of being accepted as fundamental, though differing, had been made the basis of four divergent sects of Christianity.

Taoism—the popular religion of the Chinese—was derived from astronomical conceptions of relationships between the heavens and the Earth. It was founded by a great religious reformer, Lao-tze, who was born about 604 B.C., half a century before Confucius. He introduced the word Tao, "way"—which signified the celestial pole, around which everything revolved, and in which all energy found its source. This idea became the basis of a religious system and a social philosophy in which culture is prized above possessions and militarism is condemned.

Though there are decided differences between the principles of Taoism and those of Confucianism, each system makes ethical conduct its chief object, and neither is associated with the cruelties and fanaticism of other religions. The cult of ancestor worship in China has no mythological motive, but expresses the philosophic conception that continuation of life lies not in the immortality of the soul, but in the perpetual remembrance of the righteous by mankind. The original teaching of Taoism has, however, been modified by contact with Buddhism, and Lao-tze himself has become one of a trinity of deities in a mystical pantheon.

In so far as Confucianism is to be regarded as having been a religion of China, it, too, rests upon the words of a great reformer. Whether that reform is to be called religious or ethical depends upon the interpretation to be given to the term "religion". Confucianism is essentially "a way of life". As such it might be regarded as purely ethical, if it were not for the implications of Chinese forms of religious belief. For, paradoxical as it may seem, it is possible to say that in China a man may simultaneously hold three distinct forms of religious belief—Taoism or Confucianism, Buddhism, and ancestor worship.

It is perhaps unnecessary to add that Chinese religious beliefs are extremely complex, and perhaps to the western mind over-subtle. Both Taoism and Confucianism are branches of the Universal, which might baldly be described as a form of animism. For there is in China no personal deity or being who stands, as it were, outside the system. At the head and front of this animistic system are Heaven and Earth, and the whole system works in accordance with the Tao or "Way". It was the duty of the emperor, and his repre-

sentatives, the governors of provinces, mandarins and other officials, to perform ceremonies, such as ploughing the ground ceremonially at the New Year, to ensure the proper and due working of the Tao. The emperor, as the representative of Heaven and Earth, was divine, and, in addition to the Tao ceremonial, a no less important element in the official religion was the worship and reverence paid to the imperial divine ancestors. On the proper performance of the Tao ceremonial depended the prosperity of the country and its people.

The people took no part in this official religion. Their religion was confined to ancestor worship, on which, however, there came to be grafted worship of a large number of departmental gods and goddesses, spirits, demons, and spiritual beings of various kinds. There are many Christians who represent a similar tendency to paganism in their belief in the influence of charms, omens and the stars upon their lives.

This sketch of Chinese religious ways of thinking is necessary to appreciate the place of Confucianism in its relation to the life and theology of the people. The history of China in the centuries immediately preceding the birth of Confucius in the fifth century B.C. had been stormy and disturbed. Conflict between states and feudal lords had reduced life to chaos. It is characteristic of the Chinese mentality that efforts at reform and pacification should have come in the first instance by way of a literary vehicle. Lao-tze before the days of Confucius had already stated the principles of the Tao; but it remained for Confucius to endeavour to give that teaching practical effect. Not only did he in his writings show how the individual by his personal efforts in a reformed conduct could restore the Tao to working order, but also by bringing together a small group of disciples, who lived in accordance with his precepts, he showed how his ethical system actually worked as a rule for the conduct of life.

Confucius himself claimed to be no more than a teacher; but he stands first among official sages of the Chinese, his position as such having been officially recognized by authority from time to time, until, in the late days of the empire, he was raised to the rank of "Divine Arbiter" and held in veneration equally with Heaven and Earth. As such his position may be regarded as on a par with that of the divine teachers of other creeds. From the beginning his writings have held the position of the scriptures of the Chinese.

The writings of Confucius, or rather Confucianism, are contained in five books or Classics, some, but not all, of which are held to be written by Confucius. Briefly, these contain a chronicle of the Chinese empire, going back, according to Chinese computation,

to a period equivalent to 2800 B.C., when the first emperor came to the throne. This chronicle exemplifies the working of the Tao in the past. In his ethical treatise Confucius shows how there is a logical chain involved in the working of the Tao, which passes from Heaven and Earth, step by step, through a series of grades to the individual. He then shows how society and the Way may be regenerated from its present (that is, contemporary) state of disorganization and discord to harmonious working by the regeneration of the conduct of the individual, restoring the essential goodness of his nature. Harmony will then return on the upward way through the various grades recited, until the effect at last reaches Heaven and Earth, so that complete harmonious working is restored and the regeneration of society as a whole accomplished.

It will be noted that, like Christ and the Buddha, the appeal is to the individual, and the aim the moral regeneration of the individual in order to bring about reform—in the teaching of Christ, as usually understood, in harmony with the Divine purpose; in Buddhism to attain perfection by absorption into the fundamental principle of the Universe, that is, the attainment of Nirvana; while the objective of Confucius is the harmonious working of the Universe as a whole, of which the individual is an integral part.

With regard to the sanctity of the writings of Confucius, his teaching at first produced little effect, apparently indeed was almost forgotten, when in the third century B.C. Shi'Huang of the T'sing dynasty conquered the parts of China which lay outside his own dominions and made himself emperor of China as a whole. This emperor distinguished himself by committing the whole classical literature of China to the flames.

Within a few years the Han dynasty began. The early monarchs of this dynasty, with a reverence for antiquity which in the eyes of China can only be regarded as inspired, sought to restore the old order of things. Such fragments of literature as had survived were collected and collated, and the memories of scholars and the learned were laid under contribution to restore such parts of the works of the sages as were missing. The religious element in these restored classics became the State religion, and commentaries on these documents were prepared. In the result a constitution was built up in accordance with the precepts of antiquity, which endured in this ultra-conservative State until the beginning of the twentieth century, a period of more than two thousand years.

The documents embodying the words of Confucius which had been rescued from oblivion are regarded as sacred, and in relation to his latest elevation may be held to be those of a divine personage, so

far as that conception is germane to the Chinese mode of thought. As such they are and always have been regarded, since the recension of the Han dynasty, as unalterable. In so much, however, as they deal with the State religion, which is the concern of the royal house, it was essential that the words of the sacred documents should be correctly understood. Each dynasty in turn, therefore, caused to be drawn up a body of rules or ritual of the procedure to be followed by the emperor and his representatives in order that their actions might be in accord with the teaching of the sacred writings. Of these manuals of ritual the most famous and highly elaborated was the compendium drawn up for the emperors of the T'ang Dynasty between A.D. 618 and 907, which in a measure became a model and basis for the rituals which served later dynasties.

While it is possible to say simply of Buddhism that it was concerned with the salvation of the individual, and of Confucianism that it aimed at the regeneration of a whole society through a reformation in the conduct and character of its individual members, it is more difficult to define the aims which Muhammad can have had in view. If one were to judge by results, it would appear that his religious teaching was directed to a great national revival, and was a reaction against the polytheism in the degraded forms of Christianity which Muhammad saw around him. For in so far as it seems that he acted with any motive ulterior to the enthusiasm which is the spring of action of every religious teacher, his purpose was to recreate the traditional religion of Abraham, the ancestor, through Ishmael, of his race, the nomadic pastoral peoples of the desert, as well as of the more settled agriculturists and traders gathered together in cities, with whom they regarded themselves as kin, or rather, it would be more correct to say, who claimed kin with them. In other words, the peoples known by the convenient and comprehensive term of the Southern Semites, although this applies a linguistic term to an ethnic group.

In the Koran, or rather the teaching upon which the Koran was based Myhammad embodied—as the direct word of God conveyed to him by the angel Gabriel—the tradition, the belief and the law which had been the spiritual principle in the Semitic community from the beginning, but from which in the period that had elapsed since the days of Abraham they had departed. This was to be the law, in the widest sense, governing the life of the individual, both as such and as a member of an organized community, and dealing with every department of life. To this day the Koran remains the irrefragable guiding principle in every relation of life in all Muslim communities, so far as members of that community are concerned. It is theology, ritual, civil and criminal law, and code of ethics in

one, which it is the business of every teacher, judge and ruler in the Muslim world to interpret and administer.

Much of the Koran is unquestionably drawn from Jewish sources, though as Muhammad could not read it is probable that his material was a result of oral transmission from Jews whom he met. At Muhammad's death some portions appear already to have been written down, while others had been committed to memory. The whole was collected and arranged after he died. The first version was the work of his secretary, Zayd ibn Thabit, at the order of Abu Bakr, and on the death of that leader came into the possession of his daughter, the widow of the prophet. Afterwards, however, when dissension arose in the army as to the true form of the revealed text, on the instructions of Uthman, the then ruler of the Muslim world, Zayd was again instructed to prepare a new text with the assistance of three members of the prophet's tribe, the Koreish (Quraysh). All other versions in existence were then ordered to be burnt and copies of the revised text were sent to the principal centres of the empire. This remains the accepted and standard text to the present day.

Shortly after the death of the founder, quarrels arose on doctrinal grounds as to the method of appointment to the Caliphate, resulting in the great division, which still endures, into two bodies. These are the Sunni, for whom until a few years ago the Caliph was the Sultan of Turkey, carrying with them the great body of Muslims; and the Shiah, to which the Persian members of the faith adhere. Muhammadanism, however, was not immune from the fate of other religious beliefs, which have relied on the recorded word of the founder and teacher, and a large number of sects, in number well over a hundred, sprang up sooner or later, each making its individual interpretation of the law the ground for independent existence and dissent from other groups. Although the Muslim world, on the whole, presents a united front against the unbeliever, it still remains a faith much divided within itself, but with the Word of God as delivered to the Prophet as its impregnable stronghold against assault by external forces.

X

THE BIBLE AND IDEAS OF GOD

Of the sacred literatures already considered, the Hindu sacred books are the work of priestly hands, which illustrate from a gallery of divine personages the character of divinity. Those of Buddhism and Confucianism record the teaching of one who was not originally divine, whatever share of divinity he may have acquired later according to the development of his character, as in Buddha; or, in the later view of his followers, as in Confucius. The Koran, however, shares with the Law and the Prophets of the Jews, and the Bible of Christianity, the claim to represent the actual Word of God, either by direct transmission or by divine inspiration.

Few enlightened people in these days would wish to advocate the literal accuracy of the text of the Bible upon such authority. The writings which were collected from the literature of their time and used to form the Bible are now studied as matters of history, and not as divinely inspired records in the sense formerly understood. The books of the Old Testament were originally written in Hebrew, and the earliest existing dated Hebrew manuscript goes back only to about the tenth century A.D. The history of these books is now known, and the authority of the chief scribes to record it accurately and with reverence is unquestioned.

Archaeological research in recent years within the boundaries of Palestine and in relation to neighbouring peoples and empires has thrown much new light upon the biblical historical narrative, as well as in tradition, in culture, and in belief. It has revealed the historical and cultural environment of the Hebrews when they invaded Canaan in the thirteenth century B.C., and how the scriptural records fit into it. They were influenced by the ancient civilizations of other peoples which surrounded them, and their records take a natural place in a historical setting.

While, however, the results of archaeological excavations confirm the historical accuracy of the biblical narrative, it gives no support to the view that this record has the special quality of divine revelation any more than the histories of other ancient races. Such legends and beliefs as those of the Creation, the Deluge, and others recorded in the Old Testament, were absorbed by the Hebrews from the peoples with whom they became associated, and were woven into their own history and doctrine. The Hebrews gave a new spiritual meaning to these beliefs; and if civilization is regarded as a gradual growth of higher ideals, it may justly be claimed that their con-

tribution to this type of development was far greater than that of any other ancient peoples. Their religious spirit has influenced human thought and action for more than three thousand years, whatever views may be held as to its origin or its purpose in the evolution of man.

The Hebrews were a small nation, belonging to the great Semitic race, and had much in common with the other peoples of that race—Assyrians, Babylonians, dwellers in Syria, and others—who were looked upon as heathen outside the pale of the salvation of the Jewish God. The ancient Jews left behind them fewer remains than other nations belonging to the Semitic race, whose inscriptions, buildings, and other works have been preserved, and the study of which has thrown so much light upon the manners and customs of the peoples described in the Old Testament. In the Bible, however, we have a unique record of the institutions of the Jews and of their ancestors. It is the production of many writers who lived at different periods. It is a mixture of historical facts fused with legend, poetry, folk-lore, stories and traditions, deeply devotional religious hymns, prophecies, and descriptions of scenes in the life and history of the sons and descendants of Abraham.

The view that the Mosaic account of the creation of the world and of various forms of life up to man should be accepted as an authoritative and accurate statement of inorganic and organic evolution is no longer held either by theologians, who know most about the origin of the scriptures, or among philosophers, who are best acquainted with the facts of science. Science is progressive, and many of the scientific conclusions of one generation are modified or superseded through new knowledge obtained during succeeding generations. Unless, therefore, the Bible is regarded as containing all scientific knowledge for all time, there is not much purpose in showing that science and revelation are in agreement at a particular epoch, even assuming this to be the case.

A more reasonable view to take is that the Scriptures are faithful historic records of what was thought or believed when they were compiled, containing observations of obvious phenomena only, and interpretations appropriate to the period in which they were made. Any attempt to show that the facts of modern science can be confirmed by reference to an inspired literature must be special pleading for a case which has only trivial evidence to support it.

With the advance in the technique of textual criticism in the course of late generations, with a more searching analysis of the matter of the text, and with the use of the comparative method in evaluating the tradition embodied in the narrative, it has become even more patently evident that orthodox opinion as to the authen-

ticity of the Bible cannot be maintained. In regard to the actual text, it has been possible to show that it has undergone a priestly recension in which all matter at variance with orthodox views in the post-exilic period had been eliminated, including anything which could be construed as a survival of a polytheistic or heathen character in belief. It has also been shown that the text of the early books, traditionally the work of Moses, was not the work of one hand but of several. Of these one strain had come from a people to whom God was Jehovah, while another, presumably of northern origin, was derivative from a tradition in which the deity appears as Elohim; while a third hand appears to combine characteristics of both schools. To these is added a fourth hand, in which the narrative shows evidence of a priestly origin.

The conception of the Deity in the Bible is thus by no means uniform throughout, and it is possible to indicate with some certainty the sources of the influence which has determined the character of the concept in each instance. In the early chapters of Genesis, apart from being the Creator (a Babylonian concept is here presented, though the divine creator is not peculiar to that group of beliefs) God is also the judge. The priest-ruler was the head of the City State of Sumeria. The story of the temptation and the fall of man is a version of the struggle between good and evil, which appears in the Babylonian creation legend, where Marduk (Merodach) fights against the monster, Timat. This struggle between good and evil runs all through the early eastern cults, and is well exemplified in the Aryan folk-religion founded by Zoroaster, the Mithraic legend, and in Manichaeism, founded by Mani (a Syrian who lived in the third century), and, like Mithraism, for a time a rival of Christianity.

At a later stage, for example, in the story of Joshua and the succeeding narrative of the conquest of Palestine and its consolidation against the surrounding peoples, God is the tribal god, the God of battles, jealous if his own people depart from his precepts in any way, but strong to protect them against the assaults of their enemies. From the period of the formation of the Jewish kingdom onward, God is the divine ruler, a deification of a great ruler, powerful, wise and absolute, like Solomon, but still more closely resembling the potentates from the empires further east, such as Babylon, though some of the prophets taught His love, kindness, forgiveness and mercy.

Finally, in the New Testament, the kindly All-Father appears, just, merciful, from whom all benefits flow, a conception which carries further the idea of the fertility gods, who bring benefits to man when their appropriate rituals have been duly observed, but

with the more savage features of their cults, such as human sacrifice, eliminated.

The tendency of man to make God in his own image, which appears in religious beliefs from the lowest to all but the very highest phases of their development, is at the root of the problem of anthropomorphism. According to one school of thought, all knowledge is subjective in the sense that it is derived from experience and is confined to characters and categories imposed by the constitution of human nature. On the other hand, the view is held that, while religious belief begins in an anthropomorphic phase, its development is a progression towards a non-anthropomorphic form of belief in a Divine Being, which has sloughed off the grossness and crudities of earlier creeds, and has attained to a knowledge of the divine nature as a form of real existence, known, if only in part, by an intuition and as an experience which transcends human limitations. On this view, scientific knowledge is not a mere subjective interpretation, derived from the use of the senses and intellect, of the data of experience, but an apprehension, continually growing, of an objective reality.

Between them, these two schools of thought seem to give rise to an obvious dilemma. If it be admitted that the trend of development in the conceptions of religious thought is from anthropomorphic to non-anthropomorphic under conviction of the contradictions and inconsistencies otherwise attributed to the divine nature, when anthropomorphism is carried to its logical and theological conclusion, then either the Divine becomes the Unknowable, as man's knowledge is limited by his own nature, and agnosticism results; or, accepting the postulate of an objectivity, partially and gradually revealed, the revelation of the Divine is such as transcends normal human limitations.

The religious experience, in which such a concept is attained, is thus regarded as an intuition which has to be accepted as corroborative evidence of that objective reality, but can be submitted to no test other than individual personal conviction—in other words as a dogma of theology. Hence any dogma relating to the nature of God, such as, for example, that "God is Love", must be accepted irrespective of the course of events; for to question these as evidence, or to attribute to the Deity either failure to direct events in accordance with the divine nature, or action which is the outcome of passions, such as vengeance or anger, is to question the omnipotence and universal goodness of God, and to revert to anthropomorphism by attempting to interpret His actions in the light of human conceptions and limitations.

Such, then, it would seem, is the position to which argument leads

when the "evolutionary" view of development in religious conceptions invokes the analogy of the growth of scientific knowledge—on one hand, the point of view of the agnostic faced with an Unknowable: or, on the other, the ultimate postulates of a dogmatic theology, which is not in a position to submit to the observational or experimental tests of its scientific analogue. To the resolution of the dilemma the anthropologist as such can contribute only an objective review of the facts, indicating the line of development in religious thought and conceptions, without questioning whether they point to a correspondence with an objective reality, or the reverse. The bearing of his finding on the principles of progressive "evolution" of religious concepts belongs to another plane of thought.

Though Christians are taught that "God is a spirit", the majority are unable to think of this as an abstract influence permanently pervading the universe. When they pray to God, they conceive Him as an actual Being having direct kinship with them, and willing to adjust natural or other circumstances to their desires if He decides it is for their good. To most of such believers, God is a real personality Who created man in His own image; and they cannot attach themselves to the idea of Divinity as a universal and infinite ocean of spirituality. Philosophers may show how man can rise above the limitations which the human mind in general puts upon the nature of God, but they can define no eternal and intelligent Being for reverence and worship such as the popular mind demands for its faith and guidance.

It is true that the crude conceptions of the Almighty represented in the art of the Middle Ages and later have been abandoned and that a much higher vision has taken their place. The teaching is now that the finest elements in human character reflect the nature of God, and that these were supremely manifested in the life of Jesus Christ. It then appears that the image of God is reflected in the noblest virtues of human life, and in an optical sense is not real but virtual.

In traditional Christian theology, God was apart and distinct from man; but the modern theologians conceive the idea of God as an unfluence immanent in the universe—including man. This view renders unnecessary the old doctrine of the Fall but, though recognizing the kinship of God and man, includes the transcendence of God and is in opposition to Pantheism. Modernists fit the Incarnation into the scheme of biological evolution but in their view the Virgin Birth, which few of them accept literally, is irrelevant for the Incarnation, which they regard as a higher form of Divine Immanence. The indwelling of the divine "logos" in Jesus Christ, far

from being an isolated event, is merely the culmination of an age-long creative process, and it is the will of God that through Christ the Divine Will should be accomplished in others. Christ is thus regarded as representing the emergence of a type of consciousness in man in whom divinity was consummated, and though there were no heirs of His body, His spirit has come down through the ages as an example of the attainment of perfect godliness. Whether the historical records of His life are complete enough, or sufficiently consistent within themselves to establish this interpretation, may be left to individual judgment; but humanists in general agree with Christians that the ideals expressed in His teaching, and for which He suffered death, are divinely good and beautiful.

It is not at all essential to accept the traditional doctrines of the fall of man and his redemption in order to absorb the same ideals and to endeavour to live up to them. The eternal spirit is the divine "logos" of the Gospel of St. John—"In the beginning was the Word, and the Word was with God, and the Word was God". This spirit becomes manifest in man when human nature responds to it; and in this sense there is no duality of God and man except in the sense of a stimulating abstract stimulus and the reaction to it. St. Paul himself expressed this modern view when he said, "For as many as are led by the Spirit of God, they are the sons of God".

When human beings construct a god or gods out of their own minds, they invest them with human or superhuman qualities. Two different ideas are involved in such mental conceptions. The first is belief in the real existence of a divine being or beings who can understand the devotions and offerings of their worshippers. Most people do not want to inquire whether God exists, and are content to accept their own consciousness as sufficient proof of His reality. Others find in philosophic or metaphysical thought the foundations of a belief in the existence of a god to explain the nature of human experience or the meaning of the universe. Whether a god has been created from a heart-throb or from a reasoning, he must be endowed with attributes which believers regard as worthy of worship or reverence. These degrees of excellence differ widely among different peoples and at different stages of intellectual development.

Apart, then, from belief in God's existence, the idea of His nature which satisfies a primitive savage or an evangelical Christian differs greatly from that of a modern churchman or a philosophic theologian. All that can be said is that God is what man thinks He is, and the more enlightened the thought, or the higher the ethical and spiritual standards of a community or believers at any epoch, the more exalted will be the human values attached to the deity or deities worshipped. As all conceptions of God must have the

human mind as their receptive agent, whether the influence is from within us or comes as spiritual waves from without, they must take nobler forms as man's sense of what is universally good attains to higher and higher standards. On this view, though we are still groping towards the light, we may hope to know more truly what is the nature of a Supreme Being as we ourselves create and foster divine virtues in our own nature.

This idea implies the principle, which the German philosopher Kant sought to establish, that the universe itself testifies to the existence of a moral government, or moral order, and that man's moral experience is an assurance of the existence of a Deity with moral attributes or interests. With so much evil in the world, and the absence of any ethical principles in the operations of Nature and the cruel struggles of life, it is difficult to conceive of a moral Deity indifferent to the consequences of such conditions. Many philosophers have discussed this subject and have endeavoured to explain the co-existence of good and evil in a world created and governed by a God conceived to possess moral attributes to the supreme degree of perfection, but their reasoning and their conclusions make contact only with sophisticated minds.

From the point of view of humanity itself, philosophic solutions of problems of this kind have no effective influence upon the lives of most people, who nevertheless have noble aims in their hearts and whose service promotes the advancement of mankind. The essential thing is to believe in the progressive development of the spirit as well as the body of man, and by personal service to assist in making a better world here, so that each generation rises higher and higher until it can reach out and touch the stars.

It is helpful to most people to believe in the existence of a God in whom such virtues as Love and Mercy, Truth and Justice, Compassion and Forgiveness, are manifested to a supreme degree; others may have the same high standards of human excellence before them, and live upright and god-like lives without conforming to the doctrines or practices of any religious faith. The essential fact is that there is in human nature an urge towards moral goodness, whether the ethical standards of civilization tend towards nobler and higher values or not.

Civilized man has reached the present position through a long and painful history, and his struggles against the animal qualities which he has inherited constitute a discipline which should strengthen his desire and efforts to suppress what is ethically evil. What has been achieved in the six thousand years of civilized life may represent only the incipient stages of growth of moral or ethical consciousness towards a condition so sublime that it approaches what is

conceived to be divine. Belief in the possibility of continuing this upward trend by service to high ideals is the basis of a religion which will make the world happier and better whatever sacerdotal forms may be used to express it. It is by such exalted endeavours that the Kingdom of Man will prove worthy to be called the Kingdom of God.

Whether the virtues expressed in human conduct represent, as the Stoics taught, a law which governs the universe, or are manifestations of the moral purpose of a Supreme Being in the evolution of mankind, does not affect the fact that the instrument through which the end is attained is man himself. In the sense of responsibility, therefore, we have within us what is needed to make our lives noble and harmonious; and also the freedom of will to choose between good and evil. Christianity teaches that the sources of spiritual strength are not in man himself but in fellowship with God, Whose perfect wisdom and love were revealed by Jesus Christ. This belief is helpful to many minds; but, if there has been a progressive evolution of the ethical or spiritual side of man's nature, it did not begin with the Jews or with the birth of Christ, and it has been fostered by all great religious systems and teachers. Civilization affords evidence that there is in human nature a tendency to follow high ideals, but neither science nor theology can yet pronounce a final judgment upon the source of this upward movement.

Beliefs associated with regard for justice, generosity and compassion are component parts of all high religions, and many of them have been incorporated in the structure of Christian worship and culture. The Roman Church, more especially in its missionary activities, has always shown respect for the beliefs of pagans, and is ready to adopt heathen ceremonial, processions, festivals and the like, when these do not conflict with Christian practice and when doctrine, if at all obtrusive, can be adapted to Christian belief. This is an inheritance from the early days of the Christian Church. It was an express instruction, for example, in the letter of Gregory the Great to Mellitus, the first Bishop of London, that the missionaries to Britain should show themselves considerate to pagan belief and worship, as far as was possible.

As a result of this latitudinarian attitude, it is possible to maintain that, within a century or two of the Crucifixion, Christianity had lost its original character and had ceased to be Christian. Particularly after Constantine, in the fourth century, Christianity had become a number of different religions of local origin, although in course of time these have come to be adopted as part of the general ritual and belief of the Church. Thus, for example, the Eremites—the devotees who betook themselves to the desert and there practised

austerities of various kinds and degrees of discomfort in their mortification of the flesh—were not following a ritual which belonged to Christianity, notwithstanding Christ's sojourn in the wilderness, but were adopting the practice of the fakirs, even as these act to the present day.

Similarly, the cult of the saints is a survival of the polytheism of paganism. This is an especially interesting instance, because in the cult of the local saint (or local cult of a saint) we have a survival which goes behind the polytheism of Greece and Rome. These systems were amalgams of beliefs in which local deities had been taken up into the official pantheon, just as happens in Hinduism to-day with jungle gods. Such local cults, for example, were the worship of the goddesses Aphrodite, Artemis and Pallas Athene—the goddess of Athens—and even Zeus himself—the sky god—was in places a local deity; for example, at Dodona, in Epirus.

Most interesting of all, however, is the cult of the Virgin Mary, which did not begin until the fourth century A.D. There can be little doubt that here we have a survival of the cult of the mother-goddess, which was the most deeply rooted and the most ancient of all the cults of the Mediterranean peoples, and of the cities and peoples of Western Asia extending from Asia Minor to Egypt. The hold of this cult on the Mediterranean peoples was and still is so strong that it can only be concluded that, after conversion to Christianity, the bulk of the population, more especially the less educated (as always happens) reverted to their old cult, which was then transferred to Christianity without substantial change.

The conclusion would seem to be that Christianity soon ceased to be the religion taught by Christ and His disciples, and became a number of local religions more or less according with previous local pagan beliefs. While some of these, such as the cult of saints and Mariolatry, have been adopted officially by the Church, others were regarded as heretical and adopted either not at all or by part of the Church only. Such, for example, was the fate of Arianism, which made Christ a demi-god, and Pelagianism, which denied the doctrine of original sin acquired through Adam's fall, and placed the choice between good and evil upon individual consciousness from birth to death.

As Pelagius was a British theologian it is not surprising that the British Church was notorious for its addiction to Pelagianism. The Armenian Church is still regarded as heretical by the Church of Rome and the Greek Orthodox Church. To adapt the term of the archaeologist, these cults and heresies are "developed" or "evolved," Christianity. The Orthodox Church, divided up into Russian, Greek and Slav, is another example of local development.

This view that the religion of Christianity as practised by Roman Catholic and the Orthodox Churches is a congeries of local rituals and beliefs, manifestations of different cultural traditions—it is tempting to qualify them as racial distinctions—gains considerably in significance if applied to the later cultural history of Europe. When the peoples of Northern Europe, the followers of Odin or Wotan, especially in Scandinavia, were converted to Christianity, although the sacred groves were cut down, on the whole much respect was paid to their beliefs. There is no doubt that in Northern Europe much of paganism survived for a very long time; for example, Yule became Christmas.

This religion was essentially virile. The gods were gods of battle; and it is interesting to remember that until recently, more especially in England and Scotland, it was the Old Testament with its theology of Jehovah—the God of Battles—rather than the New Testament, which most influenced the life and thought of the people. With this in mind it is possible to regard the Reformation as a breaking away of a people addicted to the virile deity of the North from the Mariolatry of a Mediterranean form of belief. Also, in the Episcopal Church, the aversion of the Nonconformist from all ritualistic practice may be regarded as a revolt from the last vestige of the pageantry more appropriately belonging to a form of religion native to Southern Europe.

Nor does the distinction stop there. For while all forms of religion, that is, official religion, in Northern Europe, with the exception of Russia and the Russian Lapps, are Protestant, none is alike in conception of the Deity in doctrine or in ritual. There is a French, German, Scandinavian Protestantism, and so forth. The extreme form is Genevan Calvinism. These distinctions are unquestionably matters of traditional culture, and here again it is tempting to consider them as matters of racial mentality, if it were not now difficult to define what is meant by racial without falling out with biological views of race. It is, however, unquestionable that certain of the religious persecutions, such as those of the Hussites of Bohemia and the Albigenses of the south of France, had racial feeling behind them, though ostensibly carried out on religious grounds.

It is interesting to note that distinctions were to be seen in the Roman Church, although it claimed to be Catholic. The Inquisition, which was instituted as a court of inquiry into heresy, was a very different institution according to the country in which it sat; and, if the persecution of witches is excepted, there was no country in which it took such strong hold, nor in which its inquiries were prosecuted with greater zeal, than in Spain, where the decisions of the court were notorious for their severity.

Even with English Christianity there are cleavages between Church of England and Nonconformist, and cleavages among Nonconformists themselves, which follow national distinctions; for example, Scotland and Wales; while in England itself the distribution of nonconformity seems to coincide broadly with certain racial distributions. The Nazi doctrine of a German God would thus seem to have, historically, something to be said in its support.

If this view is tenable, and there is not one, but many, Christianities, each a development of the original doctrine, modified in accordance with environment and local cultural tradition, is it any longer desirable or even possible to speak of a Christian Church? To this the reply must be that just as there is a recognizable physical type, notwithstanding racial differences, which is predominantly found in Europe, and a European civilization which has certain common elements, notwithstanding national and local differences, so it is in religious belief. For though Christians differ in their conception of the Deity according to their habitat, training and culture, and exhibit widely diverse modes of approach in their ritual and habit of worship, yet as a whole they have a common ethic, a common outlook, and a common point of view from which to approach the problems of life and death.

This makes it possible for members of the various sects to sink their differences in order to co-operate in those enterprises and aims which the difficulties and dislocations now arising in the working of a modern civilization impose upon men of goodwill. If those who hold the more extremely divergent positions in Christian belief should find it possible to co-operate in the advancement of mankind and the promotion of the aims of civilization in the higher sense, there is no reason why this will to work with others of different views should be confined to members of the Christian faith and should not be extended to those of faiths other than the Christian whose ethic is equally devoted to the service of mankind.

In any movements intended to bring Christian believers together it must be remembered that the different churches, doctrines and organizations of Christendom, or even Protestantism, do express a real difference in outlook on an understanding of theological concepts, whether this is to be regarded as a national, racial or cultural difference. The problem to be solved is whether this difference of racial or cultural outlook is so fundamental that the difference in doctrinal concept precludes co-operation on an ethical basis.

The problem of co-operation becomes infinitely more complex when we have to consider not merely the different points of view of the various Christian Churches, but have to take into account also the different outlook and the various cultural backgrounds of

the peoples of the other great systems of religious belief of the world.

There are now, however, hopeful signs of a movement towards unity on fundamentals. The essence of all great religious systems is belief in the attainment of high ideals by devotion of service to them. Different individuals and communities require different doctrines and rituals to bind them together in worship of any kind, but all such formularies are only ancillary aids to a universal faith in the possibility of ascending towards the highest good by human endeavour. It is on this principle that all leaders of religious movements should be able to unite with the common purpose of promoting whatever may be called divine in the nature of man.

Summing up this general survey of anthropomorphic conceptions of divinities, it may be said that the evidence goes to show how, from the most rudimentary stage of human emotion and speculative thought, man imposed his own nature and the "forms" of his own mind on the unseen, and in the light of his understanding of his own being evolved a doctrine of causation which he applied to the universe as he knew it. As knowledge of the character of this universe increases, the sphere in which these supernatural forces have effect is correspondingly reduced and with it the scope of the conception of direct divine intervention on humanistic lines. At the same time, the conception of Deity is spiritualized until it becomes either an Unknowable which lies behind all things, or a rational principle immanent in all things, but to be realized only by intuition.

Looking at the facts of development in religious ideas, there would seem to be an evolution of the human mind, neither orderly nor equal in its advance, but on the whole of an upward trend in a contest of ideas, which, when the religious emotion is strongly aroused in the finer type of mind, becomes stronger than the quest for food, the call of sex, and, in the final resort, even than the desire for life itself.

Whatever knowledge has been obtained of the attributes of a deity or deities having superhuman powers over Nature and human affairs, is a product of the human intellect. When Christian teachers say that friendship with God is essential to knowledge of God, and that men should cultivate conduct which He would approve, they are only stating a principle which has always been fundamental in the attitude of man towards the divine. If, however, the truest knowledge of God can be obtained only through human personality, then Christianity has no monopoly of Him and all truly religious aspirations have contributed, and are contributing, to the spiritual evolution of man.

In the field of religious beliefs truth is relative to the object of

belief, and is still as departmental as ever it was. The principle of universality of the human spirit, which is a condition of world-wide co-operation, has not yet been generally accepted in religion or in other provinces of emotional manifestation.

To some extent at the present time the particularist spirit of self-protection, with an ideal which takes the place of a god, has been diverted into the channel of nationalism. More potent, however, is the fact that an ever-increasing number, appealing to the conditions of modern civilization in a widening circle, is not content to rest in the particular, but must pass on to the universal. To such, neither restrictions of national distinction, nor differences between creeds, can weigh in the balance against the ethical principles explicit or implied in all the higher forms of religion. In this composite but practical creed, it is permissible to consider the movements toward world fellowship as representing a further and higher stage in the development of religious belief, in which the theological differences which antagonize will be forgotten in the pursuit of a common and universal moral purpose.

XI

OLD DOCTRINES AND GROWTH OF NEW

As a general observation on the period between the centuries on either side of the birth of Christ, with special reference to the East, it would appear to have been a time of a very great emotional and intellectual ferment, in which there was displayed a general and widespread interest in religious and philosophic speculation. For example, the activity of Hellenistic philosophy; the neo-Platonic philosophers and the Alexandrine schools (all these, however, rather earlier); the development in the doctrine of the Stoics, especially in regard to the doctrine of the brotherhood of man, which proved of such assistance in spreading the doctrines of Christianity, and undoubtedly affected the character of Christian ethics; Mithraism, which reached Western Asia about the same time as the rise of Christianity; the search of the Jews for a Messiah; the spread of the worship of Isis and other mystic cults to the Roman world, where they attained great popularity, and so forth.

It is to be noted that further east, in these centuries B.C., there was

considerable activity in Persia and in India, where Buddhism was at the height of its power in its native country, while in China the rise of the Han dynasty from the third century B.C. onward was bringing about an intellectual, moral and political regeneration on the principles of the philosophers Lao-Tze, founder of Taoism, and Confucius, who came after him in the sixth century B.C.

In the Nearer East it is possible that this intellectual ferment may have been a repercussion, in part from further east, especially in the spread of Persian ideas relating to powers of good and evil, but in part also due to the rising power and expansion of the Roman empire, beginning with the victory of the Romans in the second Punic war, just before the beginning of the second century B.C. (205 B.C., Battle of Zama), the fall of Carthage (146 B.C.), and the capture of Athens by Mummius in the middle of that century (149 B.C.).

The religion of Mithra, widely spread throughout the Roman empire in the early centuries of the Christian era, was almost exclusively a cult of soldiers, traders, and slaves. Although the Mithraic cult was introduced to Rome by the Sicilian pirates captured by Pompey in the first century B.C., it was slow in making headway, until it received encouragement from the emperors as a religion of the legionaries, on account of the support it gave to the divine right of kings. When once it had taken hold, however, its spread was rapid, favoured, as also was the spread of Christianity, by the unity and uniformity of administration of the empire.

Mithra, or Mithras, first appears as one of the old Iranian deities or spiritual beings in the *Avesta*, that is, dating from a period prior to the parting from the Arya tribes who invaded India. He appears again, fighting on the side of Ahura Mazda (Ormuzd), as a power of light, and in the references to Zoroastrianism in Hellenistic literature. It would thus appear that the cult spread with the conquests of the Persians, one branch reaching the Euphrates, another settling in Cilicia. Apparently, however, the cult did not reach Western Asia until about the beginning of the Christian era. By this time it had become associated with the Sun, and had taken on something of the character of a mystery cult, such as was familiar to the Hellenistic world, of which evidence also appears in Christianity; for example, in the common ceremonial meal—the Last Supper.

As already mentioned, the cult came to Rome from Cilicia in the first century B.C. By the time of Augustus it had made little headway, but its influence grew as Rome's contact with Asia increased. The army, apart from its eastern contacts, favoured the cult, more especially the emperor and what may be called the Higher Com-

mand, by whom it was regarded as a bond of loyalty, because of its support of the divine right of kings. This was a survival from the Persian belief that a legitimate sovereign ruled by the grace of Ormuzd, who bestowed upon him, as a mark of favour, a celestial aureole of fire, like the halo of the Christian saint. A development of this belief was that this aureole was given by the Sun. Mithra was then identified with Sol Invictus, and thus became the giver of authority and victory to the imperial house.

The downfall of Mithraism began about A.D. 275, when the province of Dacia was lost and, also, Christianity became aggressive in its attitude. It continued to be the cult of the army with the emperor's favour until the conversion of Constantine to Christianity. For a brief period there was a revival under Julian the Apostate, but it weakened with the victory of Theodosius in A.D. 594, surviving only in isolated districts of the empire, such as certain parts of the Alps.

The Mithra legend has been lost, and such account as can be given of it is a reconstruction and interpretation from the material remains. This consists of sculptures—of which some of the best known come from the north of England, along the Roman Wall and York, where the legionaries were quartered—and chapels, underground grottoes, and caves, and imitations of caves. Some of the grottoes would hold from fifty to a hundred worshippers. It was thus a secret or mystery cult, to which women were not admitted.

It is said by Tertullian, who was born at Carthage about A.D. 150 and was one of the greatest ancient writers on the Christian Church, that, like the Christian religion, the Mithraic cult had among its members bodies of celibates, "*virgines et continentes*", though the former are scarcely consistent with the statement that women were not admitted to the cult. Possibly they were associated with it, without actually taking an active part. The members of the community formed a corporation, much as did the Christians, which was supported by voluntary contributions.

The tenets of the cult promised immortality in union with a god: but a high moral standard, with an observance of the ritual, was demanded. A member of the Mithraic community regarded himself as a soldier fighting with Mithra on the side of good against evil. Those who so conducted themselves were rewarded by gaining the original beatitude of the soul. This is essentially an Eastern ideal, which also appeared in the Greek world later; and it may be compared with the Indian pantheistic conceptions.

The relations between Christianity and Mithraism were anything but cordial, and scarcely such as to encourage borrowing. In fact, the close resemblances between the two cults caused intense hostility.

The principal points at which the two cults came into contact were in Rome itself, in Africa, and the Rhone valley—which was a very early and much frequented trade route.

The resemblances to which students of Mithraism have directed attention include, among a number of others, and in addition to those already mentioned, the fraternal spirit and the humble origin; the use of bell and candle, holy water and communion, the sanctification of Sunday (each day in the week was connected with a planet); the special character of December 25; the insistence on moral conduct, abstinence and self-control; Heaven and Hell; the atoning sacrifice; the warfare of good and evil; the immortality of the soul; the last judgment and the resurrection. As also mentioned, some of these elements seem to be derived on both sides (Mithraism and Christianity) from the mystery cults, while others appear in Manichaeism.

When the incorporation of pagan elements in early Christianity or Roman (Catholic) creed and ritual is remembered, it may be asked why Christianity made no attempt to subsume the Mithraic cult, when there were so many close resemblances between the two.

A consideration of the "machinery" by which pagan elements were incorporated in Christian practice and ritual shows that it was not the Church organization which incorporated these pagan elements, but the converted pagans themselves. They modified Christianity to suit their traditional practices and rituals. The conversions, of which we hear so much in the early spread of Christianity, were no more than formal. The chief of a tribe might undergo a change of heart after argument with the missioner; but when he was converted, with him were baptized his whole people or tribe. For example, in the seventh century Bishop Paulinus is said to have baptized ten thousand Northumbrians in one day.

There can thus have been little opportunity for the individual to attain conviction. When later it came to the practice of the Christian religion, these tribesmen continued to hold much the same beliefs as before, and practised at least the more cherished elements in their own ritual, with the result that sooner or later many of them were permitted, and some, such as the cult of the mother-goddess, adopted as the official practice of the whole church. Hence the intolerance of the north for the Mariolatry of the Mediterranean.

It is not surprising that the record of early Christianity in the Gospels includes references to customs and practices which, though not recognized as pagan, were survivals in Jewish society of pagan origin. The disciples and early Christians, belonging to the lower strata of society, and being of artisan or peasant origin, probably, as this class always does, had retained popular elements of belief

and custom, which had disappeared, or were despised among the educated, and thus do not appear in secular literature.

The Crucifixion coincided in time with the spring festival of paganism and with the Passover, which itself in some obscure manner was associated with a sacrifice of the first-born. Jesus died on the day of the Passover as "the Lamb of God, which taketh away the sin of the world". The clamour of the Jews for a victim suggests a survival of a spring sacrificial observance with a human victim, which the evidence collected by Fraser in *The Golden Bough* shows was or had been general in pagan Western Asia. The tongues of fire which descended with the gift of tongues on the apostles at the feast of Pentecost suggests an origin in Sun worship, especially when it is remembered that the halo bestowed on the legitimate monarch by the Sun in Persian belief was adopted as a mark of the saint in Christian art.

Much that is incorporated in the narrative directly concerning Christ suggests that He has been invested with the attributes of the wonder worker or shaman. This is not only in the matter of the miracles. Thus, for example, the sojourn in the wilderness for forty days corresponds to the preparation in isolation for a period, which is the initial stage in the making of a shaman all the world over, the temptation being analogous to the spiritual experience which some of them claim. Mortification of the flesh is a common practice in the East, going back in all probability to a very remote period.

Again, the story of the child Christ instructing the doctors in the temple is a characteristic of the legends of most great religious teachers of the East, and is almost certainly apocryphal. It may be compared with some of the stories of the child Buddha in the *jataka*. which is a Buddhist collection of traditional and other tales.

All the holy men of the East are said to work miracles of one kind or another. The remarkable feats which have been attributed by travellers to Tibetan Lamas (priests), or the performances of Indian fakirs and even conjurers, are said to be due to the possession of supernatural powers, but the only sense in which they are miraculous is in their unusual character or ingenuity.

When religion is studied as the expression of the spirit of man throughout the ages and among different peoples, its many types are seen to be branches of a tree having its roots in primary emotional characteristics of humanity. Christianity is one of these boughs; and it has borne some of the richest fruits because it has been pruned from time to time of growths which would keep out the sunlight of knowledge. It is only by the wise removal of such superfluous or unprofitable shoots that a religion can be made a structure worthy of progressive intellectual development. The scientific method of

ascertaining evidence before arriving at conclusions as to its meaning is now applied to sacred as well as secular history, and the historical religions of mankind are examined calmly and dispassionately in the pursuit of truth.

The principle of natural growth applied to religions enables their relative influence and importance to be understood and their origin and development to be traced, but the meaning and purpose of the human instincts which lead to them are beyond its scope. What are the intentions of the existence of the universe and the spirit of man may be imagined without being rightly understood. Conceptions of this kind are theoretical explanations of the relations between mind and matter and their creative source. In religion, they lead in some cases to intensive absorption in what is thought of as a universal abstraction, and, in Christian ascetics, to a beatific vision. In each type mundane interests and animal appetites are disdained in order to attain a condition of communion with what is believed to be divinely sacred.

Indifference to the world and events in it, and contempt for all knowledge except that derived from spiritual experience through personal communion with the Supreme Being, are characteristics cultivated by the mystics of several religions. The spirit is that of "weary of earth and laden with my sin" and of renouncing all associations with what are regarded as human desires and aspirations, to ensure ineffable union with what is conceived to be the divine nature.

The famous medieval work, the *Imitation of Christ*, is ascribed to a fifteenth-century revered Augustinian monk, Thomas à Kempis, who, following St. Augustine, said, "Better surely is an humble rustic that serveth God, than a proud philosopher that, neglecting himself, studieth the course of the heavens".

The whole intention of the admonitions in the four books of the *Imitation* is not to promote earthly welfare but to prepare the reader for everlasting life through spiritual grace. Though labour is to be undertaken for the public good, the aim is eternal bliss for the performer of it; and all knowledge of this world, or human association with creatures in it, is contemptible and vain. "Far more noble is that learning which comes from above, from the divine outpouring," says Thomas à Kempis, "than that which is painfully acquired by the wit of man." Complete withdrawal from the world, and disbelief that there is any good in it, or any hope that man can make it anything else but a place of sin and suffering, are taught as the only means of approaching divine grace. The same ascetic attitude is expressed in an inscription on one side of the archway of the mosque of Fatehpur Sikri, near Agra, in the words: "The

world is a bridge, pass over it, but build no house upon it. The world endureth but an hour, spend it in devotion."

In this spirit, religious exercises of Christians had for their purpose the reminding of man that he is born in sin and by nature evil; that the human race is ignoble, and must remain so upon the Earth. The life of the soul could be ensured only through the death of human senses. The more often people confessed themselves miserable sinners, the more holiness would they acquire for the day of judgment when the end of the world would come, and "infernal fire" with "burning pitch and stinking brimstone" would torment those who had not prayed devoutly or continually expressed contrition for being born at all. An omniscient and omnipotent Being had created the world and man, who had early fallen from grace and was destined to eternal torment unless he believed in the sacrifice of a Redeemer. All human wisdom and knowledge were of no avail, and salvation could be secured only by accepting this revelation of God's purpose in Christ's death as well as in His life.

These crude and cruel conceptions of the Christian religion are still held by large preaching communities, and are believed to be justified by literal interpretations of biblical texts; but they are too odious to higher human feelings to be associated with the idea that "God is Love" and are now rarely taught to enlightened congregations. Insistence upon the acceptance of such doctrines, even though they are expressed in the articles of belief and the creeds, is not now regarded as essential for admission into the Church of England; and it is permitted to attach symbolic or metaphorical meanings to words used by Christ, St. Paul and other Apostles, and the expositions of early Christian Fathers. The tendency among many leaders of this Church is to ask for nothing more than belief in a Supreme Being who created the universe, established laws which rule it, and watches the evolution of man upon the Earth.

These, however, are modern views, and most followers of the faith would condemn them as almost blasphemous. The majority of worshippers in Christian communities cannot think that heaven and hell as places have passed away; that the doctrine of corruption of the whole of the human race by the disobedience of Adam and Eve, as related in the Book of Genesis, has been abandoned as based upon a primitive legend; and that with it have gone the propitiation idea of atonement, upon the nature and meaning of which there have been many doctrinal differences, and the association of the idea with the Virgin Birth and the Resurrection. Devout inquiry into these formularies of religious faith has shown that they had their origin in legends and folk-lore, and that insistence

upon submission to them as a condition of admission to Christian fellowship is a legacy which need not be accepted.

It is now acknowledged by modern churchmen that the historical evidence for the doctrine of the Virgin Birth is extremely weak and untrustworthy. St. Matthew and St. Luke are the only apostles who mention it in their gospels; and in several of the other books of the New Testament it is clearly implied that Christ was born by normal generation. The stories associated with the Nativity in the two gospels mentioned belong to the realms of poetry or legendary lore rather than to history; and it is impossible even to reconcile the accounts given by St. Matthew and St. Luke. The earlier works of the New Testament, and some of St. Paul's Epistles, are not only silent about the Virgin Birth, but also actually refer to Christ as if He were born in the natural human way; implying, therefore, that He was man. In St. Paul's own words (1 Timothy ii, 5): "For there is one God and one mediator between God and men, the man Christ Jesus."

The silence of Mary, the mother of Jesus, upon the question is very significant; and equally important is the fact that Joseph is often referred to as the father of Jesus. The evangelist St. Mark points out that the four brothers were not impressed at first by Christ's mission and His friends believed Him to be mad. It is not recorded that Mary ever reassured them upon these and certain other relevant points. Except, therefore, the stories of the two Evangelists, Matthew and Luke, as to the supernatural birth of Jesus, there is little in the synoptic Gospels to suggest that He was other than human.

Much has been made of the prophecy of Isaiah, expressed in the familiar words, "Behold, a virgin shall conceive, and bear a son, and shall call his name Immanuel". The word "almah" in the original text means, however, "young woman" and is so rendered in Jewish translations of the verse into English. St. Jerome, who completed the translation of the Old Testament in A.D. 385, was aware of this, yet he used the word "virgin"; and St. Matthew made the same error when he said "a virgin shall be with child".

St. Jerome exercised great influence upon the women of his time, and he exalted the state of virginity to heights previously undreamt of; hence the doctrine of the Virgin Birth spread rapidly and became firmly established in Christian belief. Most modern churchmen now, however, do not consider the Virgin Birth essential to the doctrine of the Incarnation, which simply teaches that God revealed Himself in human form in Jesus of Nazareth. The Christian Church never actually said that Jesus was God; and, as evidence that He was not so accepted, many passages in the gospels of St. Mark

and St. Luke bear witness. The true view is that the divine life was lived under human conditions by Jesus, and human perfection is manifested supremely by it.

The doctrine of the Immaculate Conception, though not the same as that of the Virgin Birth, is closely related to it. It was promulgated by Pope Pius IX as a dogma *de fide* in 1854, and states that Mary in the first instant of her conception, by a special grace and privilege of Almighty God, in view of the merits of Jesus Christ, was unsullied by original sin. It is difficult to understand why, if Mary herself, though born of natural generation, could be preserved from the stain of original sin, Christ Himself should not also have been born naturally and preserved similarly from the taint of original sin. Whatever view is taken, the dogma of the Immaculate Conception includes the doctrine of the virginity of Mary and the miraculous birth of Christ.

What the Incarnation of Christ actually signified, or what are the relationships between Father, Son and Holy Ghost, were bitterly discussed in the early days of the Christian Church; and since then scores of theologians and philosophers have endeavoured to reveal the mystery. In the fourth century of our era there was much controversy among leaders of the Church concerning the natures of God and Christ. The learned presbyter Arius taught that God was one and eternal, and that Christ was derived and created by Him, and therefore not eternal. At a general council assembled at Nicaea in A.D. 325, it was decided that the Son was "of the same substance" as the Father; and Arius was excommunicated for promulgating a doctrine which would make Christ a kind of "demi-god", and not, in the orthodox sense, "perfect god". The opposing school of theologians regarded this view as polytheistic and a reversion to paganism, in which the worship of Christ would be idolatry.

Athanasius, who is often described as the "Father of Orthodoxy", was the most zealous opponent of Arianism, and it was he who established the belief, embodied in the Creeds, that Christ was an eternal Son as divine as the Father, and therefore equally to be worshipped. Later, his assertive theology made the Holy Ghost also truly and fully divine, like the Father and the Son.

Even if the Incarnation is understood to signify that in Christ only was the divine spirit supremely manifested, it does not follow that belief in either the Virgin Birth, or the Immaculate Conception of the holy Mother, is necessary for its acceptance; both are only dogmatic expedients to absolve divinities from the taint of original sin assumed to be involved in human procreation. A much nobler idea is that the spirit of love in a divine sense pervades the universe and is revealed by the intuitive response of humanity—Christian or

pagan—to it. It is impossible to believe that, in Christ, "The Word became flesh and dwelt among us" without bringing in the legend that He "was incarnate by the Holy Ghost of the Virgin Mary", or believing that Incarnation was limited to Him alone. The best sense in which to interpret the phrase "God is Love" is to think of Love as a universal influence for good, and as represented by the highest attributes of human life. A philosophical conception may thus be combined with a theological belief.

It would appear from this interpretation that incarnation means much the same as inspiration when applied to moral or religious teaching, and that both are of the nature of responses to an influence permanently pervading the universe. It is just as reasonable to assume the existence of this medium, whether it is called God or given any other name, as it is to believe that space is filled with a subtle elastic fluid called "luminiferous ether", bringing to us light and other radiations from the stars. Nothing is known of the nature of this ether, which is really only the name of a hypothetical agent mentally created to account for certain physical effects, and which may be regarded as synonymous with "space".

To philosophic theologians, moral and other human values are perceptions which can similarly be accounted for by assuming the existence of an immanent medium which conveys vibrations to the spirit of man instead of to his senses. All spiritual light may thus be said to come from the "Father of Light", and all noble inspiration, whether in Buddha, Confucius, Christ, Muhammad, Milton or any other guide to godliness, to be derived from the same source.

In Buddhistic philosophy this condition of complete absorption into the universal spirit is attained by teachers who have vowed to suppress their animal nature, in which all evil is held to have its origin. In the fourteenth century Tsong-kha-pa, a religious reformer, introduced into Tibet a modified form of Buddhism which had first reached that country in the seventh century, and out of this came the conception of the Dalai Lama as the incarnation of the holy apostle of Buddha, who was the ancestor of the Tibetans.

According to Lamaistic belief, when a Dalai Lama dies his spirit or soul may be reincarnated in the body of his successor, born at the moment of his death, or may wander about until it finds a perfect place for its human habitation. The Magi, or wise men from the east who brought offerings to the infant Christ at the Nativity, were represented in Buddhism by the search party which, in 1939, found the new Dalai Lama in a child some five years of age, born in Amdo Ari near Kumbum in Siling. A rainbow is said to have appeared at the time of his birth; and also it is alleged that the search party was led to the house by a vision.

These signs, and his recognition of the holy members of the search party, were reverently regarded as marking him out as the fourteenth incarnation of the Dalai Lama, and he was installed with elaborate ceremonies in the cathedral at Lhasa in October, 1939. Whatever view may be held as to the religious beliefs and magical practices of the Lamaistic monks of Tibet, their doctrines of Apostolic succession through the reincarnation of a divine spirit is just as reasonable as—perhaps more so—the view that all Christian bishops immediately after their consecration are in possession of special divine grace.

As with the doctrines of the Virgin Birth and the Immaculate Conception, another alleged supernatural intervention in the normal course of human existence is represented by the belief in the Resurrection of the body of Christ. A similar belief existed in ancient Egypt, where Isiris, who was regarded as being of divine origin, was killed and mutilated by the powers of evil and rose again to become king of the underworld and judge of the dead.

Direct historical evidence of the Resurrection of Christ in the flesh can scarcely be regarded as convincing; and is altogether insufficient from the point of view of natural science. Belief in it can be secured only through faith in spiritual vision, which cannot be submitted to material judgment. The accounts given by the writers of the Gospels are so divergent that they cannot reasonably be reconciled. No one actually saw the Resurrection, though it is stated that many witnessed the appearances afterwards. St. Luke places these appearances of Christ round about Jerusalem, whereas other writers refer almost entirely to Galilean appearances.

All that is certain is that, after Christ's death, something happened to restore the confidence of the broken and dispirited band that fled at the time of the betrayal and trial. It was not His earthly body but the spirit of His teaching that survived the Crucifixion. Apparent defeat and failure were turned to victory; and it is in this light that the words of the Creeds and the records of the Evangelists must be read, with the hope—and it may be nothing but a hope—that in the end good will prevail over evil, though the process may be slow and painful.

With such an interpretation, the Resurrection becomes a symbol; and belief in it as an eternal truth in the manner commonly accepted may be no longer demanded as a test of orthodoxy. Even if there had been a physical resurrection of Christ's body, the relation between such a miracle and the death of human beings is not clear; because, if it is assumed that He was God, the conditions and circumstances were entirely different from those which are the lot of mortal men.

Apart from the question of the actual Resurrection of Christ's body, it is difficult to understand how this could be a proof of the immortality of human existence. The Apostle Paul was, however, in no doubt as to the meaning of the resurrection of the physical as well as the spiritual body; and at every burial service of the Christian Church we are reminded of his words: "Now is Christ risen from the dead, and become the first-fruits of them that slept. For since by man came death, by man came also the resurrection of the dead. For as in Adam all die, even so in Christ shall all be made alive".

It is possible to attach a spiritual meaning to much of St. Paul's teaching concerning Christ's death and message, but in his Epistle to the Corinthians, from which the above words are taken, he clearly states: "In a moment, in the twinkling of an eye, at the last trump; for the trumpet shall sound, and the dead shall be raised incorruptible, and we shall be changed. For this corruptible must put on incorruption, and this mortal must put on immortality".

St. Paul, however, knew nothing, about the nature of organic life, or of the actual difference between living and dead things. He thought, with others of his time, that before a seed could germinate, or be quickened, it had to be devoid of life, and therefore, with mistaken arrogance, he said, in reply to his own questions, "How are the dead raised up? and with what body do they come?" "Thou fool, that which thou sowest is not quickened, except it die". To anyone who knows anything about the changes which actually occur when a seed germinates, the reasoning based upon the assertion of "sown in corruption" and "raised in incorruption" is both specious and irritating. Even if the analogy were sound, it would afford no proof of the immortality of human beings.

In recent years it has become increasingly evident that this and other traditional beliefs cannot have a place in progressive thought apart from scientific knowledge and historical evidence. Responsible leaders in the Church of England to-day represent a new and enlightened attitude towards the so-called "heresies" of scientific thinkers, which convulsed English society in the nineteenth century from the days of Dean Buckland down to the pitched battles which took place on the scientific positions of Charles Darwin, T. H. Huxley, John Tyndall and their successors. It is not strange that most church-goers, and all who have been brought up to accept the traditional interpretations of Christian teachers, regard the acceptance of such views as a capitulation to the forces of modernism and scientific materialism.

They derive their religious convictions from faith in what they are told has been taught for centuries and accepted as divine revelation; no new knowledge or rational interpretations can ever appeal

to their consciousness. There are still people who believe that the Earth is flat; and not many years ago this view was fervently advocated in public discussions in Great Britain. Fundamentalists and others with inert minds moulded in orthodox shapes would be surprised to know that they are in the flat-earth stage of belief in traditional Christian doctrine and are regarded as such in the light of the new interpretations derived from increased knowledge.

A creed is a short summary of Christian doctrine and there is really no finality of truth in it. The creeds of the early ecclesiastical councils were formulated in terms of the knowledge and philosophy of the times, and they should not be used to polarize thought or suppress new conceptions. History shows that religious beliefs, like other component elements in human society, are products of a specific tradition and culture, and in the course of time they undergo a process of development, or evolution in the popular sense of the term.

The present attitude of modern churchmen towards matters of doctrine implies recognition of the fact that, just as, in scientific investigations, hypothesis—for example, as to the nature of the universe, or as to the antiquity and descent of man—is subject to modification in the light of increased knowledge, so, in matters of theological doctrine, orthodoxy is not static but must vary in connotation with increase of understanding and a clearer view of the cosmic process. Further, that such understanding may bring about changes in forms of belief, without affecting faith in the central doctrine of Christianity.

It may seem that to hold such a view of the relation of the evolution of theological dogma to the development of scientific thought is to make the validity of religious belief dependent upon the finite intelligence of man, and that it is incompatible with the tenets of a religion which takes its stand upon divine revelation or doctrinal interpretations of historical records. Yet it is possible to regard both the growth of scientific knowledge and the development of dogma, each in its own respective field, as two sides, two aspects of the same process—the search for truth, in which a Divine Purpose is revealed gradually to man *pari passu* with the preparation of his heart and intellect to receive it with understanding. The essential thing is to regard divine revelation as continuous and progressive, with no dogmatic finality in the expression of its truth, whether relating to natural science or natural theology.

XII

SCIENTIFIC THOUGHT AND EMOTIONAL VALUES

THE relative values attached to faith and reason determine the shapes of religious beliefs. The adjustment of the two elements into rational systems has engaged the attention of many theological philosophers and has been endorsed by ecclesiastical authority in doctrines and creeds, interpretations of which change with the expansion of knowledge. These intellectual aspects are beyond the range of thought or desire of the human society to which they are presented at any stage of development and are, therefore, commonly accepted without question as final truths. What has to be remembered and taught is that particular doctrines and principles of orthodox belief represent the results of councils or assemblies at particular epochs, and that in a living religion the interpretations of their meaning must be subject to literal modification.

Two great Christian philosophers whose theologies were based on different compositions of faith and reason were St. Augustine (354–430) and St. Thomas Aquinas (1225–1274). St. Augustine held that adoration based upon belief in authoritative teaching was the first essential and that reason must be subsidiary to it. On the other hand, St. Thomas Aquinas was the founder of a philosophy in which reason is more closely harmonized with faith in a natural theology, and revealed doctrines with demonstrable truths. Each of these princes of Christian teaching was the founder of a theology which is dogmatic in the sense that it must be accepted without reservation by all who profess the Christian faith. Thomism is in fact the official philosophy of Roman Catholicism, and, like the dogmas of that Church, is not to be examined in a critical spirit.

St. Thomas was a leader among the scholars of his times, rich in knowledge, ripe in wisdom and with wide human interests. His mind was deeply influenced by the works of Jewish and Muslim philosophers and he was the leading Christian exponent of the doctrines of Aristotle. He had a better understanding of astronomical and physical science than other philosophers of medieval times, and of its contacts with social and political problems. In his attitude and outlook upon these subjects his works have the same high rank as those of leading natural philosophers of our own days. Within the framework of Christian dogmatics he built up an ordered system

of the world on the conception of the sovereignty of God vested in the people and delegated by them to a monarch or the State whose duty it was to preserve the fundamental rights of man.

St. Thomas's rational theology differs from the scholastic theology of the Middle Ages by advocating the principle that truths can be demonstrated by human reason without the aid of separate revelation. Following the teaching of Plato, the movements of celestial bodies were ascribed to a force which could move of itself and was God. Similarly, God was the first and Uncaused Cause of all effects, and existence leads to the idea of something necessary behind it. Goodness, beauty and truth exist in different shades as abstract qualities, but the absolute standard of excellence in them is represented in the postulate of a perfect God. These cosmological ideas have been reformed and modified by later philosophers without altering the theistic argument that Nature as a whole is not a self-explanatory system.

The rational theology of St. Thomas was more acceptable to Jews and Muslims who studied it than to some leaders of the Catholic Church during his life and afterwards. It was condemned by the University of Paris and the University of Oxford shortly after his death. Even after it had become the official doctrine of the Dominican Order it was opposed by the Franciscan Order and caused a dogmatic schism between the two.

The two essential principles are, however, accepted not only by all Christians but also by followers of other faiths. They are belief in a divine spirit and dependence upon it as the prime source of moral law and influence throughout the ages. Conceptions of the nature of this spirit and the relations of human life to it constitute religious belief with its varied and varying forms of growth and rituals. With the exception of Buddhism, each of these faiths and their sects tends to be intolerant of the others and requires unquestioned adherence to its dogmas, though none has the right to claim exclusive possession of ultimate truth.

This arbitrary judgment is expedient inasmuch as it defines objects and methods of worship from which followers of a faith must not depart, but it imposes restrictions upon thought and action which foster credulity at the expense of reason. There are many religions and each one is believed by the faithful to represent the true standard of relationships between man and divinity, or body and spirit. Each has its own doctrine or philosophy and all who do not accept it are denounced as infidels.

The "holy wars" of the twelfth and thirteenth centuries had secular motives and territorial ambitions as their cause, but the spirit used to inflame them was that of fervent religious faiths, Christianity on

one side of the conflict and Islam on the other. In each the extinction of an infidel was encouraged as a righteous act to be rewarded in Paradise with elements of supreme delight. Followers of Muhammad held that the only true religion was Islam and gave the personal name Allah to this self-existent and divine object of worship and militant action. In essence and sacred attributes the monotheistic basis of their faith is much the same as that of Jews and Christians, and from a humanistic point of view this unity of belief in a single God should lead to concord rather than conflict. Religion is, however, more emotional than rational, and fervour for a particular form of its expression can easily become fanatical.

Among modern civilized peoples a more tolerant outlook is coming into being, and it is recognized that the great religions of the world have high ideals of spiritual influence and social righteousness in common, though their forms and objects of worship vary greatly. In a scientific sense every religion is a philosophy, but unlike science their doctrines are pronounced as sacred truths which cannot be departed from without dangerous heresy. Whenever and wherever this dogmatic attitude prevails, religion becomes a refuge for the intellectually indolent and a haven closed to traffic in progressive knowledge.

Most people are content to remain in the spiritual shelter in which they are born and to accept without question the rules and regulations prescribed by the religious teachers who are their custodians. These laws, like those of natural philosophy, have the human mind as their instrument of expression, but are held to be sacred and final because they are derived from revelation and represent ultimate realities. Every society needs to have standards of conduct for its members in order to ensure stability; and in great religions these are associated with high moral values as well as with devotional exercises towards divine beings.

Such abstract ideas as love, charity, brotherly kindness, truth and justice have, however, to be given concrete form in order to become objects of worship. When these images represent supreme moral or divine sanctity, veneration for the symbols of such high attributes, whether seen in the Sun and stars, Buddha, or the crucifix, is a desirable and natural feeling to cultivate. When, however, these things are worshipped as agents having or transmitting personal power over Nature and human fortunes, they become not only superhuman but also supernatural and are idols of superstitious minds.

The existence of this universal power is assumed in all religions, but the observances necessary to come under its influence vary greatly in time and place. There is no one-and-only true faith; but

as the great majority of human beings are content to be told what to believe about the nature of the unknown, it is better that they should have confidence in an anchor provided by their religious teachers than to sail through life without one. The main thing from a humanistic point of view is that the principles of a faith should promote a way of life in which the cardinal virtues of justice, temperance and fortitude are combined with hope and charity as noble ideals which can be strengthened by attachment to them.

There are many ways in which these principles may be put into practice, and in their perfection they are reverenced in both man and deity. The influence of a religion can be measured by the closeness of association of its shepherds with human virtues and the ways of living of their flocks. It may be socially expedient for the guardians of traditional sayings and ancient writings to pronounce them as sacred and final truths and thus to attach divine right to their authority. This, however, necessarily involves credulity regarding the supernatural, and therefore scepticism, because there will always be human minds which doubt the validity of the evidence of supremely divine association claimed by any particular religion. Francis Bacon expressed the static and dynamic attitude in cogent phrases when he wrote in *The Advancement of Learning* "If man will begin with certainties, he shall end in doubts; but if he will be content to begin with doubts, he shall end in certainties".

What every one of us knows with certainty is that we exist on a globe which is a speck in a material universe and that knowledge gained through our organs of sense is not a mere phantasy of the mind. The more we discover about ourselves and our environment —terrestrial and celestial—the nearer we shall approach ultimate truth as to the relationships between matter and mind, or body and creative spirit. If Nature is the reflection of a universal mind, whether this be Plato's "best soul" or a conceived form of deity, then patient study of her ways is the best course to follow in order to appreciate the intricacy and vastness of the universe and to endeavour to find its unifying principles.

In a philosophic sense, knowledge acquired through our bodily gateways is as much to be distrusted as that revealed by intuition, and the only true certainty is thought. This conclusion is expressed in Descartes' famous dictum, "I think, therefore I am"—a principle which leads to the view that universal causation is to be found in the thought of a perfect Being or God and that this is the ultimate reality. Without acquaintance with the elements of logic and metaphysics, the soundness of the foundation of this principle cannot be effectively questioned though it need not be accepted. The attitude of the scientific inquirer towards the world which affects his

senses becomes in Cartesian philosophy, "I am, therefore I think".

In other words, this amounts to saying that human beings exist with sensory organs and emotional feelings and that the brain is their centre of intelligence, whether regarded as a receptor of a universal stimulus or as a concourse of atoms upon which sense-experience is impressed and in which images or ideas can be created without being actually perceived. The science of psychology is concerned with functions and phenomena of the human mind studied by observation and experiment, and it does not pretend to pass final judgments upon matters beyond the limits of experience. That is the position taken in the pursuit of all branches of natural knowledge; and though the complete scheme may never be viewed from it, new aspects of fact and thought are continually being presented with the single purpose of discovering what is true in the realm of Nature.

All that can be done by this kind of scientific effort is to describe ways and means of natural processes and to represent them by systems which can withstand the test of knowledgeable criticism. A scientific discovery does not create anything new in Nature, but only reveals what had previously been unknown or overlooked. Science does not, therefore, have authority to institute natural laws or impose any ideas upon them, but only to discover the modes of their working and to reduce these to a code with a unifying principle. Its laws are derived from the Book of Nature and are empirical in so far as they are based on observation and experiment, though theory is involved in their interpretation. What we know about this Book has the human mind as its vehicle, whether the traffic is in objective things or transcendental ideas.

There is evidence that a race of human beings which approached the human type existed half a million years ago, but the period of civilization as now usually understood does not go back more than a few thousand years. The actual records of human history thus occupy only a single page, the remainder of the chapter of fifty or so pages being mostly blank, or their contents deduced indirectly from evidence of conditions of body and intelligence at different stages of growth.

If the appearance of life in its simplest form on the Earth and its relation to the inanimate world be taken as the beginning of the Book of Nature, then the first chapter began more than a thousand million years ago. Throughout this appalling reckoning of time, the markings on the corridor show that the vista of events has been influenced by the same forces as those which produce effects now, though their actions had not been codified as laws. While, there-

fore, the single page of cultural history covers a period of about ten thousand years, there were before it one hundred thousand periods of the same length in which life existed in one form or another upon the Earth. There were thus beauty in natural forms and scenes, and efficiency in adaptive structures, long before the mind of man was able to appreciate them in wonder and worship or react to them constructively in works of art and invention.

Whether the world was created for man, or man happens to have become the sovereign of it through the development of particular instincts and characteristics over great periods of time, he, like everything else, is subject to the natural forces around him, and these existed eons before he came into being. Many natural structures, scenes and sounds afford delight to human consciousness and arouse the feeling of beauty; and the existence of such æsthetic emotions is often used as a manifestation of a divine spirit in man. As, however, there are no absolute standards of beauty of form or phenomena, and as the organs of sense are purely physical structures which respond only to a limited range of influences, it is presumptuous and irrational to suppose that such effects in the human species signify a creative will and purpose. As soon as the solid Earth had a misty atmosphere, the rays of the Sun led to gorgeous colours appearing in the sky at dawn and sunset, and beautiful bows were formed by raindrops many millions of years before Noah saw in the rainbow a covenant between God and him to preserve the perpetual generations of living creatures from destruction by another flood.

It is one thing to appreciate natural, intellectual or moral aspects of beauty, but another to glorify their creator and the possession of senses to perceive them. If the structure of the universe represents the unfolding will and purpose of perfect thought, then everything in it may be said to have a beautiful meaning. The greater the knowledge and the broader the outlook, the more extensive is the range of appreciation of the handiwork. The only measure of value in beauty is that of the pleasure or charm evoked in the mind by it. It varies, therefore, with the mental attitude towards the impulse, whether æsthetic or scientific, and becomes orthodox under different conditions of development in time and space. It represents the expression of human emotions which may or may not be associated with the idea of supreme intelligence in its creator.

The orderly and intricate arrangements of atoms in crystals result in most wonderful structures without the guidance of instinct or intelligence. They are the products of purely physical forces which construct diamonds from the single element carbon, and guide the two molecules of quartz into their places to produce rock-crystal, amethyst, jasper, onyx and many other gems from them. Thousands

of these wonderful geometrical designs were formed by natural processes long before there were human beings to appreciate their beauty; yet the skill represented by them is mechanical and not purposive.

Insects, birds and other living creatures are guided by their instincts to become builders, miners, masons and decorators in the construction of their dwellings. They afford examples of mass production rather than of individual experience and craftsmanship. The skill to make these things is transmitted from one generation to another in much the same way that matter is mechanically moulded by physical forces to produce crystalline forms and other inorganic structures.

When a design is reproduced by instinctive reactions to materials and circumstances it is independent of intelligent thought and the pattern remains fixed, whether to human eyes it is beautiful or otherwise. When observation and training are used with instinctive desires to imitate and improve designs, a new sense of appreciation comes into the picture, and art becomes an expression of thought as well as of feeling. This faculty is not essential to the maintenance of existence, but it makes life richer and its development is a characteristic of the human race.

Whether the songs of birds charm the human ear or not, or the forms and colours of any living creature appeal to æsthetic feelings, has nothing to do with their existence. They are characteristics which have enabled the groups possessing them to survive by inherited instincts and without conscious cultivation of ideas of beauty or its meaning. What they represent is the impulse to construct and reproduce common to all creatures and not the contemplative attitude towards beauty peculiar to man. Their motive is practical and not the creation of beauty for men to admire.

When the bower-birds of Australia prepare their wonderful silvan dance-halls they show a taste for beauty of design and decoration not excelled by the nesting structures of other flying creatures. The bower is constructed by the male bird by selecting blossoms and other things of various colours, some without apparent discrimination but others corresponding to the plumage and similar insignia of his female mate. Each species of bower-bird has its own preference in these respects, but why this should be so is as unanswerable as why human eyes should think the bowers beautiful. Some male birds paint or plaster the walls of their bowers with fruit pulp, macerated wood, or charcoal and other substances, and all display what is regarded as high artistic tastes in both the form and decoration of their breeding places.

It is difficult to distinguish between the purely physical forces by

which beautiful crystals and microscopic plant structures are produced and those in which instinctive impulses are used for the design. It is equally difficult to draw a line between instinct and intelligence from a comparison of their artistic achievements. As an abstract idea, beauty, like goodness and truth, is eternal; and human reactions to it are emotional. Nothing in Nature is either positively ugly or beautiful, but anything may inspire æsthetic feeling and be expressed in a way which arouses emotion.

In this sense the function of art is not the faithful reproduction of natural truths in scenes or sounds, but the representation of creative insight into them. Art may thus be said to have nothing to do with natural forces, but with emotional concepts expressed in words, lines, colours or sounds arranged in a way which stimulates response in receptive minds. Whether craftsmanship is art or artifice or not depends upon the fusion of the real and ideal into a harmonious pattern which appeals to the throbbing human heart.

In all living creatures with the exception of man the impulse to construct leads to forms which have become stereotyped by inherited behaviour. Creative ideas are the essence of human art whether expressed in the earliest drawings of prehistoric times, in symbolic representations of conceived attributes of deities and demi-gods of Egypt and Assyria, Greece and Rome, of Christian saints, or of Mona Lisa in Leonardo da Vinci's painting of her face.

When a young child sketches in a few lines the figure of a man or any other living thing it does so for pleasure; and the drawing satisfies the child as true to life, whatever impression it may make upon other minds. Such copies of objective realities constitute a kind of picture-writing and merge into the ideographs of China and the hieroglyphs of Egypt to become a language. It is easy to pass from the stage of copying natural objects to that of endowing them with particular qualities. The earliest drawings of prehistoric man, like those of children, are naturalistic, but they develop into conventional designs and symbols which convey general impressions of fact or thought.

When looking at the glow of a hearth fire or clouds in the air, it is often easy to imagine that their forms resemble human features or familiar natural objects. Lines of markings on rocks, shapes and colours of animals or plants, and abnormal growths, may similarly have been recognized by primitive man and created the impulse to copy what he saw by drawing or modelling a plastic material. He may not have done this deliberately at first but may have discovered that he had by accident produced a resemblance to a real object. The conscious reproduction of a design or shape by the use of hand and brain differs from the constructive impulse which leads birds

and other living things to select particular colours and shapes for their nests or other purposes.

Recognition of familiar forms in Nature, desire to imitate them by drawings or modellings, and the will to express this urge, were the basic factors of primitive artistic effort. Prehistoric drawings of men and women and of hunting scenes belong to the latest stage of magical art, and their purpose was not so much to represent past scenes as to give effective promise to the future. Imitative art thus passed into the representation of ideas of a community kind. Creative vision combined with human skill then outlined the elements of a language of feeling which has many branches, but all having their incentive in a universal urge to give concrete form to thought.

Styles of expression of thought may be classified, but they represent only degrees of consciousness and cannot be referred to absolute values or reduced to empirical principles. It is possible to analyse a rich symphony into a mathematical succession of musical notes and to identify the pigments used in a masterpiece of pictorial art, but the formulæ obtained can have no relation to the emotional reactions stimulated by such finished harmonies of sound and visions. The two separate attitudes of analytical and aesthetic minds in their outlooks upon the works of Nature and of man were beautifully expressed by William Watson in the words:

> Science and Art, compeers in glory;
> Boast each a haunt divine.
> "My place is in God's laboratory;"
> "And in his garden, mine".

Each has his own part to play in the pursuit of truth and in the cultivation of faculties to perceive it.

XIII

RELIGION AND SOCIAL ETHICS

THE essential principle in religion is faith in the existence of spiritual powers or actions which transcend natural laws of life. Whatever the faith may be, loyalty to it binds believers together and separates them from infidels. It demands, above all other things, homage to divine influences or a Supreme Being, and is not necessarily concerned with ways of living, moral codes, or systems

of philosophy. In this sense, spiritual communion, explicit or implied, and conformity with practices pertaining to it, define communities into Christian, Muslim, Buddhist and other religious groups independently of human conduct or social conditions. When worship of the divine is associated with the enlightenment and advancement of the human race by material and spiritual works, then science can be reconciled with religion in the ideal of duty or service in a noble struggle and a sublime hope.

There has always been a difference between the religious and scientific attitudes of mind and always will be, because the outlook of one is defined by arbitrary doctrines, while that of the other is continually changing. Worship is as natural a desire as hunger, and it finds expression in many forms of religion. Just as definite in human nature, and side by side with it in the history of civilization, is the constructive urge manifested in the arts and associated with knowledge of the natural properties and agencies discovered by observation and experiment.

All that early man knew about natural laws were their influences and effects, and like other living creatures he had to adapt himself to them in order to survive. His primary needs were food, clothing and shelter, and he lived where he could obtain these things for himself and his family. Instinctive feelings, coupled with the volition to move from one place to another, led living creatures from insects to man to form social communities in which every member has a part to play. Such communities can be preserved only by cooperative effort, which in animals generally means specialized labour and functions, and in man the acceptance of principles of government for the common good.

With social insects like bees, wasps and ants, these principles have become crystallized into instinctive habits and have no relation to the freedom of consciousness. The statutes and regulations made by human legislators are very different from these more or less mechanical responses to external influences. They prescribe codes of conduct enacted for the common good of the community for which they are enacted, and institute penalties for offences against them. Unlike universal natural laws, the rules recognized by any community as binding and necessary to preserve the social structure vary in time and place. A working and worthy "way of life" may be based upon moral or ethical principles, as in Confucianism, or be associated with a Supreme Being, as in Hebraism, Christianity and Islam. In each case certain observances and rules of conduct are prescribed, but whereas an offence against secular law is a crime, a transgression against the spiritual decrees of a religious faith becomes a sin.

The authority or sanction for law is social custom, and this applies to sacred as well as to secular regulations. In most societies at one time or another religious duties are as much an integral part of the code of legal statutes as other principles recognized by the members of a community as being for the common good. While, however, every religion sanctifies its own doctrines and observances, these differ widely from one another and among themselves. No one can reasonably hope for, or expect, an amalgamation of these various faiths in which each loses its distinctive character, any more than there can ever be a uniform code of conformity to custom. There are, however, certain basic principles of human conduct essential for the collective security of every society, and these may, or may not, be included in religious sanctions.

The rights and duties of man everywhere constitute the common ground upon which all peoples can meet in fellowship, whatever their faith may be in divine powers, or with none. The prime factor is the Golden Rule concerning relations of man to man—"Do not unto others what you would not they should do unto you" of Confucius, or as given positively in St. Matthew, "All things therefore whatsoever ye would that men should do unto you, even so do ye also unto them." This sublime ethical conception is to be found in the sayings of all the living religions of the world and in the earliest stages of civilized life. As a moral principle its high standard is difficult of attainment among individuals or communities, but it is nevertheless a fundamental note to which the strings of all human hearts are able to respond. It is the core of right social relationships, by whatever strands of faith in man or divinity the rope may be entwined.

Though man is a separate natural species, individuals and types vary so greatly in their qualities and circumstances that no particular religious faith can ever become universal in its doctrines. From infancy, thoughts and emotions in every country are polarized in directions determined by fixed ideas and customs, which become laws of right social and religious behaviour long before they are inscribed in statutory codes. There is little difference in many societies between doctrines made sacrosant by their association with religion and rules of cooperative conduct which members of a community are expected to observe in affairs of everyday life.

The essential feature of the civic organization of Sumeria, the earliest district of ancient Babylonia of which documents have survived, was its religious character. The most comprehensive code of Laws of Hammurabi, who was King of Babylon about 2000 B.C., is represented upon inscribed tablets as being received from the hands of Shamash, the Sun-God. This code brought together laws

and customs which had been in existence in Sumeria many centuries before it was compiled. It makes provision in detail for every contingency which might be expected to arise in the daily life of the community, and in the relations of its members, and it is a remarkable monument of legislative skill in enactment.

Much of the legislation of the Hebrews recorded in the early books of the Bible is closely connected with Hammurabi's Code, if not directly derived from it. The idea of a creative deity as the original law-giver is common to both, and also to other social and moral codes. Traditional learning combined with superstition led to different conceptions of the Supreme God and His relations to man and different systems of worship. The cultivation of credulity regarding the supernatural is an element of most religions, primitive or advanced, and most people are content that this should be so. When, however, the superstitious aspect predominates, it is often associated with clerical authority over ways of living in preparation for life to come and a passive attitude towards material conditions of existence. From a humanistic point of view the civilizing influence of religion is not to be found in strict observance of doctrine and ritual, but in what it does to promote righteous thought and action among members of the community and ensure progressive social enlightenment.

In theistic religions, conceptions of God represent standards of perfection by which devout believers strive to shape their lives. Doctrines and creeds crystallize these ideals, and they vary in time, place and circumstance. Ethical ideals, like forms in the organic world, similarly undergo development and differ according to chronological period, geographical distribution and social environment. In the beginning they derive their compelling force from reference to the claims and needs of a given form of society, and afford no guidance for conduct between man inside and man outside the group. Any form of belief can be judged by its influence in creating a desire to attain high ethical ideals. The process and the standard may vary, but if they result in the individual or the general good they are helping human development by making men understand that they must help themselves.

Whatever the nature or grace with which he is endowed, man has freedom of will and action and is therefore the potential master of his fate; and his justification is not to be measured by unreasoning faith in creed or doctrine, but by his life and works. In the highest sense of Christian teaching, service to God means individual and corporate cooperation with Him in fulfilling a divine purpose in the scheme of a universe in which life is an experiment and man a stage in it.

There is no question here of personal reward for goodness or punishment for evil, but only encouragement to work for a higher human destiny, and thus render service to a divine spirit and to man. It is unnecessary to define God if this ideal is accepted as the purpose of man's existence; and a rationalist can endeavour to live up to its standard of goodness even though his philosophy does not include a divine personality.

Religion expresses the collective ideals of a society, and its ethical or moral influence results from active cooperation with the spirit of this sentiment. All categories of thought, including that of science, may thus be regarded as of religious origin: they are all concerned with the realities and meaning of Nature, man and society. Scientific thought is thus only a form of religious thought derived from further knowledge. Science accepts the fact of religion and the influence of religious faith, and it seeks to understand them in spirit and in truth and to promote what is good for human welfare in both. With increase of knowledge, much of the mystery upon which religious speculations are based is revealed, and new ideals or gods have to be constructed to satisfy the rational mind. It is only when there is a refusal to recognize this essential function of progressive knowledge that conflict arises between religion and science.

Goodness is as difficult to define as beauty. When it is associated with religion it becomes godliness and its standards of sanctity vary in time and place. If the biological principles of variation of character, struggle for existence, and survival of the fittest, are applied to social evolution, then at any stage of civilization good conduct is that which conforms to what is conceived to be high social ideals, and evil is that which is in conflict with them. Good acts are distinguished by their adjustment to the social order, and had by their failure to do so. Good conduct falls within the order: bad conduct fails to adjust itself and is condemned. Conduct is determined by character, and character in man implies action guided by a will conscious of moral or ethical standards. It may thus be distinguished from the instinctive or unconscious impulse which, in other creatures, represents reaction to a physical stimulus.

In the course of his biological evolution, man has become possessed of an erect posture, the power of visual convergence, and the co-ordination of the sense of hearing with the muscles of articulation, by which his range of speech has been greatly extended. By the use of these characteristics he has been able to emancipate himself from the limitations imposed upon him by Nature and to create a world of his own. He has thus superimposed an artificial life upon his natural life, and introduced a process of cultural evolution which is independent of natural conditions, except in so

far as they may be used for his own ends. Like other creatures he inherits certain instincts, but every human being has to acquire knowledge and wisdom for himself.

By the exercise of their instincts, social insects such as bees and ants carry on their marvellous communal work from one generation to another, but always in the same natural way, and only where natural conditions are favourable for their existence. Each new generation of insects can survive only if it is born under these conditions; and the children of men are no better provided for in their infancy. In civilized communities they come into being in circumstances which are purely artificial, while their inherited instincts are purely natural.

The biological characters of civilized man are the same as they were six thousand years ago, in spite of all individual and social attainments. Each generation starts with the same natural instincts, yet each has to learn afresh to adapt itself to an unnatural environment, and to acquire a new consciousness of what is good or evil. The social and cultural conditions change, but human nature remains in most respects unaltered, except perhaps in the capacity to learn and the means of passing on wisdom and knowledge to succeeding generations. The only sense in which we can truly say that we stand on the shoulders of our ancestors is that we can see more of their achievements and are provided with more powerful weapons to subdue Nature, both materially and spiritually.

From a practical point of view, what constitutes right behaviour thus varies with cultural conditions, and its character is represented in time and space in the story of civilization. What man is in himself, and what are the ideals of righteousness, are conceptions which have largely influenced the course of human development and have been the roots of progressive effort. The ethics of human conduct taught by Confucius in the sixth century B.C. had as its basis the belief that the nature of man was innately good and by instruction and example could be prevented from degeneration. His moral code was a way of life to which high ethical principles were applied, without association with theistic doctrine and completely opposed to the idea that man is "born in sin and shapen in iniquity". It made virtue and morality a matter of knowledge and example sanctioned by society on the elements of goodness within human nature itself, instead of seeking guidance from supernatural influences.

In all ethical systems and in all high religions certain elements of "goodness" or virtue are esteemed, and the purpose of education is to nurture them. In the Homeric period of Greek history the virtues were bravery, reverence, prudence, and temperance, and

an advanced stage of ethical culture was attained by the teaching of them. Socrates taught that "right knowledge is virtue", while Aristotle held that the aim of teaching should be not the virtue of knowledge but happiness or goodness, which in the individual meant "well-being" and to the community "well-doing". Religion had little effective influence on these and other educational philosophies of classical Greece and Rome, whereas the lofty conceptions of religion and morality were combined with practical purpose in ancient Hebrew education. With these nations, however, intellectual education was confined to certain classes, and all other peoples were regarded as inferior.

This is true notwithstanding the broad democratic ideals of the period which culminated in the "Golden Age" of Pericles, in which the aims were to promote individual development and emphasize human interests so as to live happily and beautifully without arbitrary control by the Gods or the State. The Sophists were missionaries whose horizon extended beyond that of their own State, and they travelled from one place to another to impart instruction in their principles. To Protagoras—one of their greatest leaders—is attributed the formula "Man is the measure of all things", which implies that morals are conventional ethics and the standard of their value is utility. The School of the Stoics, founded by Zeno of Citium, laid stress upon moral principles, but taught that reason alone could determine a life of virtue as well as of wisdom and physical health. The universe was regarded as a rational, though material, whole in which all men were reasonable beings and had, therefore, mutual philanthropic relationships.

In the emphasis they laid on the brotherhood of man the Stoics made their ethical principles transcend political boundaries and paved the way for Christianity in conjunction with the Jewish concept of the equality of man before God, which had taken the place of earlier tribal parochialism. Socrates differed from the Sophists in regarding man not in the sense of a single individual, but as the expression of a rational and universal self in which truth is knowledge so far as man can understand it, and knowledge is the basis of practical and moral worth. Plato agreed with Socrates that virtue consisted in knowledge, but sought for universal truth in "ideas"; and "good" was the harmony of them with objective realities.

All these and other classical philosophers, whose principles or doctrines created social structures which have greatly influenced the course of civilized development, belonged to the intellectual class; and the moral or practical significance of their ideals could be

understood only by relatively small groups of their communities. With the coming of Jesus of Nazareth, a manual worker became for the first time the founder of a new system of social ethics. He was not a scholar in the usual sense of this word, and the only evidence that He could write is that when the woman in adultery was brought before Him, He "stooped down, and with His finger wrote on the ground". His teaching was, however, democratic in its emphasis upon the brotherhood of all men, making education universal and abolishing class distinctions. It appealed to the spiritual nature of man through filial reverence, not of natural ancestors but of one Father of All, and to the attainment of virtue by service in this association instead of through the development of reason.

Six centuries earlier, Gautama Buddha taught that the way to the cessation of ill in the world was by the Aryan eightfold path: right view, right aspiration, right speech, right doing, right livelihood, right effort, right mindfulness, right rapture. The ethical virtues were to be attained by knowledge; renunciation; benevolence; kindness; abstention from lying, slander, and abuse, from taking life, stealing, and carnal indulgence; by using the mind to distinguish between good and evil states, and the will to follow its guidance towards perfection; by the control of feelings, thoughts, and ideas to overcome the hankering and dejection that are common to the world; and by the purification of individual life, so as to pass beyond grief and lamentation to the dying out of ill and misery, the attainment of right method and the realization of Nirvana, in which individuality is lost by absorption into the supreme spirit.

A less ascetic and more practical code of right conduct was that which Confucius shaped in the same period and which has been the chief influence upon the life of China since then. He was once asked, "Is there one word which may serve as a rule of practice for all one's life?" The Master said: "Is not Reciprocity such a word? What you do not want done to yourself, do not do to others".

The founder of Christianity could have known nothing of the ethical teachings of the two great Eastern philosophers, yet, as human nature is much the same everywhere, He was often confronted with the same questions as to right behaviour. The second commandment which He gave to one of the scribes who questioned Him was, "Thou shalt love thy neighbour as thyself," which expresses the single rule of Reciprocity stated by Confucius.

The basic principles of Christian ethics are the Fatherhood of God and the Brotherhood of Man, but what are esteemed as virtues and what are condemned as vices have varied greatly even in Christendom. Though the distinctive attributes of Christian ethics

are said to be obedience, unworldliness, benevolence, purity, and humility, these and other measures of ethical behaviour are common to all high religions and are included among human ideals. Their recognition and application have marked the course of civilization, even though service to them has been interpreted variously by different peoples and in different parts of the world. In medieval times the seven capital sins were personified as Pride, Lechery, Envy, Anger, Covetousness, Gluttony, and Sloth. The seven principal virtues are said to be Faith, Hope, Charity, Prudence, Justice, Fortitude, Temperance. The first three are called theological virtues, and the other four cardinal virtues.

In Christian philosophy, appreciation of all or any of these virtues and qualities, and attainment of excellence in their service, are measured not so much in terms of social ethics as by adoration of perfection in a life to come. The aim of early Christian schools of thought was spiritual rather than intellectual, and the ideals of "well-being" and "well-doing" were not for worldly but for other-worldly preparation. This resulted in a period of stagnation in education and social ethics, relieved only by the influence of a few great Christian philosophers, of whom the English Venerable Bede was an outstanding intellectual example. He was not only the greatest historian and theologian of his time, but also a scientist who made personal observations of natural phenomena and referred many of them to natural causes.

In the age of chivalry of the eleventh to fourteenth centuries, duty to noble service gave refinement to the character of the warrior. Love, honour, loyalty, and piety were esteemed as major virtues, and courtesy, courage, obedience, and respect for women as minor. The aims of the period of Scholasticism were to bring the Christian faith into harmony with reason. In the same period Saracen learning was brought to Christian Europe through the Crusades, and it awakened the scientific spirit of freedom of thought, understanding and speech. With the Renaissance in the fifteenth and sixteenth centuries this spirit influenced ethical ideals and made reason the guide to truth.

The Humanities next came to mean the study of classical languages and literature—of words instead of objective realities. Even when modern languages became vehicles of expression, verbal realism was the measure of knowledge. So it remained until in the seventeenth century Francis Bacon made an organized system of inductive philosophy a means of providing physical, moral, and social development through direct observation and experiment and rational understanding of their natural meaning.

The principles of moral and social development admit of scientific

study, and the science of ethics is concerned with the discovery of their characters and influences. Unlike principles of the natural sciences they cannot, however, represent common agreement relating to verifiable knowledge. When derived from relationships between man and his environment they vary according to cultural conditions, and though their influence may be compared their systems cannot be referred to absolute standards of measurement.

There have been many such ethical standards during the past six thousand years of what is called civilized life, and the record of them belongs to the history of human culture. Mesopotamia had a long cultural history extending over three thousand years or more, but when once the cultural pattern was fixed, depending as it did on the character of the environment, it suffered little fundamental change. Other conditions of natural surroundings, and the power of man to bring natural forces and resources into human service, have resulted in other civilizations, each of its own kind and surviving so long as it was best adapted to existing human needs and concepts.

After two thousand years of Christian teaching it has to be confessed that the nations which have received it are little better in their moral qualities than others in the past or the present. This is not an indictment of principles but of the failure of peoples to follow them. The improvement of means of living, and the broadening of man's intellectual and social horizons, usually associated with the meaning of modern civilization, are results of scientific discovery and mechanical invention; and progress in these has never been encouraged by religious teaching. The lag between advances in natural knowledge and those in the spiritual field is due to beliefs that it is more important to maintain supernatural feelings than to adjust right social and ethical conduct to changing conditions of life. Men of many nations, with and without profession of particular religions, have contributed to the improvement of these conditions by their works and their teaching.

Material progress must in its nature be more striking—more patent to observation—than progress in man's ethical and social development: it is, therefore, no more than to be expected that there should be a lag in the latter. The gap is widened when more attention is given to religious doctrines than to the social and ethical duties of men to one another, which are the basic principles of Hindus, Muslims, Buddhists, Confucians and Rationalists as well as of Christians. It is on such principles that there rests the hope of building the whole fabric of human society on a new model.

This is the common purpose of all men who cherish goodness in their hearts and goodwill towards their fellows, and upon it are

based standards of world ethics. There are many supporters of social reforms and world reconstructions other than those who profess the Christian faith. When the movement towards social development began more than one hundred years ago, its chief agents were the Philosophic Radicals, so far as its aspects were apart from Christian Philanthropy. Some of these men were regarded as virtually atheists, but on social questions they were allied with Quakers and other philanthropic and religious reformers. Among them was Jeremy Bentham, whose formulation of the ethical basis of conduct, the "end" and purpose of the State as "the greatest happiness of the greatest number", if a philosophic dogma, at any rate comes as near to being a normative ethical principle in applied social science as was possible in his day.

The problem now, as it was a century ago, is to adapt the social and economic systems to the new conditions brought about by advances of science and invention, but its scope comprehends the whole world and not the population of a single country or nation only. The principle of utility was the basis of Bentham's doctrines, and the purpose of his doctrines was to provide a solid foundation for both morality and law by right relationships between motives of pain and pleasure, or social evil and good. In the same period Immanuel Kant took a world view of moral philosophy in which the fundamentals, as in every moral system, were liberty and justice.

These basic principles were not conceived for the construction of a world State in an Imperial sense, but for a "World Commonwealth" in which each State respected the individuality of others and the moral law within them would be extended to their mutual relations. The elements of this law are to be found in the principles of world ethics, and all schemes of world reconstruction are concerned with their place and service in reconstituted plans for the welfare of the whole human race.

When one tribe or nation attacks another with the object of acquiring new territory or of imposing particular ideals upon the vanquished by military force, it transgresses these principles, even though in such conflicts divine aid is invoked, whether through magic or religion. From this point of view it is repugnant to human feeling and ethical ideals to represent Hebraism and Christianity as possessing particular knowledge of divine will and purpose in the processes of Nature and the life of man. On standards of world ethics and cultural development much that was done by the descendants of Abraham, after their escape from bondage in Egypt on their way to the Promised Land and later, was barbaric and on the moral side no higher in intention and action than the conduct of the people around them.

When Moses delivered Israel from bondage in Egypt about 1220 B.C. to lead them into the land of Palestine, he announced himself as leader of a band of immigrant people having sacred covenants with the one and only God. As with other peoples, the moral code imposed by the Decalogue was for strict observance only as between the people of Israel and afforded no guidance for conduct between man inside and man outside the group. The Jews believed themselves to be a people "chosen" to occupy the Earth; and neither the sanctity of personal possession nor the injunction "thou shalt not murder" influenced the warlike and aggressive followers of Jehovah when they fell upon and despoiled tribes on their way.

From the earliest times there have been similar migratory movements and military campaigns, and they all belong to the natural history of human societies, whether the strategy and tactics are believed to be directly derived from a deity or not. It cannot reasonably be held that many of the incidents related in the Old Testament are other than barbaric or are rendered less infamous because they were believed to be in the service of God and His Covenant with Moses. They were no higher in moral motive than those associated with other movements of expansion in the history of civilization, and no more worthy of reverence.

Even in the World War of 1939–1945, divine authority and guidance were claimed by Japan and Germany in their ambitions to bring all parts of the world under subjection to them and subvert the principles of truth, justice and liberty which are the best elements of civilization. Through the national faith of Shintoism, the Japanese believed themselves to be the "Chosen People" just as fervently as did the Israelites and with a divine being always on Earth to lead them to material conquest without consideration of higher human aids. Germany had the same intentions when in 1939 Adolf Hitler made the World a welter of blood and tears, while even he invoked the name of an Aryan God and appealed to the stars for guidance. He claimed that the German Herrenvolk were the "Chosen People" to possess the world, and by merciless horrors his agents slaughtered more than one-third of the sixteen million human beings of the ancient faith of Hebraism who were given this title in biblical history.

Crimes of this kind are deliberate transgressions of the basic moral laws of human societies and high religions. They happen and have existed throughout the history of civilization because there have always been people and nations ready to think and act devilishly on the principle of "Evil, be thou my good". Their justification is to be found only in the struggle for existence in which all forms of

life are engaged in diverse degrees from birth to death, and are contrary to the ethical attributes of human nature.

We know that these qualities are part of the make-up of man and that consciousness of them persists at different levels of moral judgment in individuals and in groups, but it is as difficult to define the course of their development in terms of goodness as to distinguish between what is essentially sacred and what profane in the emotional impulses and reactions of religion. What is known is that the human race is aware of this consciousness and by the exercise of its faculty is capable of departing from the principle of Nature "red in tooth and claw" to which all other forms of life are subject and have to submit.

Man is truly Nature's insurgent son when he rebels against these conditions of material life, and measures progress not by standards of advantage to himself or his particular people but by increased regard for the rights of others and devotion to service in the creation of a world society, instead of separate combative communities each working for its own interests and looking to biological competition rather than symbiotic cooperation as the natural plan of life.

In a biological sense it can be held that war between tribes, races and nations serves the function of a "pruning hook" by cutting off the group physically or mentally weak and increasing by conflict the chance of survival of the victors. It can also be said that those people who, in response to their needs for expansion or in defence of their frontiers, have not been prepared with efficiency to appeal to the arbitrament of arms, have run the risk of extinction and often have suffered that fate. There is, however, no ethical or natural foundation for the view that the actions of any single group, however small or large it may be, are guided by special divine Providence in its favour, nor for regarding the survival or expansion of any group as the working out of a divine plan of spiritual development of the human race as a whole. Such ideas derive their force from the conception of a tribal deity and can find no place in the principle of the Fatherhood of God and the Brotherhood of Man now emphasized in world religion.

XIV

RISE OF MODERN EUROPEAN CIVILIZATION

It is said that twenty-one civilizations have come into existence in the past six thousand years, but the number depends upon the definition of "civilization". Stages of European civilization pass from the Neolithic and Bronze Ages to the Iron Age and the Celts into the Roman Empire, which broke up into the "New Rome" of Byzantium with its profound influence on the cultures of the Slav peoples, and Roman Christendom, which encountered in the centre and north the invading tribes of Germanic and Scandinavian cultures. This movement, which came to an end with the crowning of Charlemagne and the foundation of the Holy Roman Empire, was followed by the uprising of nationalities and the fall of Constantinople, when modern European civilization begins.

European civilization is rooted in the East. When European culture as considered by the archæologist emerges from pre- into proto-historic times—say at the beginning of the first millennium B.C.—the European peoples are broadly speaking at the tribal stage of social development. Tribal migrations at the beginning of the Iron Age had swept away, or were in process of absorbing, such advances as had been made in Bronze Age culture. Troy had fallen. The great empire of Knossos and its kingly heirs of Mycenae and Tiryns had vanished, leaving little trace behind. How far Knossos contributed to European civilization, beyond traces in material culture, it is impossible to say; but it is legitimate to assume that its contribution was little or nothing, so completely was all memory of this great civilization obliterated by the invaders from the north. Nothing but a vague tradition remained, until the discoveries of the latter half of the nineteenth century of the Christian era.

In a tribal society, even though that society may be an aggregation of lesser units, the fundamental conception of social organization is separatist. Each group regards itself as sharply marked off from all others. In such a society the ideas or conceptions which are here regarded as characteristic of modern civilization could not arise, and for their origins we must look outside Europe to the East. Even the great Celtic empire, which in the view of certain archæologists dominated Western and Central Europe, and even invaded the East, in the centuries immediately preceding the Christian era, was, it is admitted, an area of cultural uniformity held by a number

of peoples of common tongue. Possibly it was largely of common racial character, but it was not a political entity in the sense in which that term applies to the great kingdoms and empires of the East, or capable of producing that unity in thought and concept for which we seek. The ideas here regarded as inherent in modern civilization, which it is suggested originated in the social and religious conceptions of the great empires of the ancient East, may thus be stated as follows:

First, the integration in a single political unit under a common social organization or group of peoples, originally discrete in race, culture and religious traditions. These peoples were brought under a single rule by conquest or other method of absorption, but were welded together for common well-being (not always, be it noted, of their own will), and came to regard themselves as all more or less akin and united as members of a single community or nation.

It was in this manner that the separate territorial groups—afterwards nomes—of Egypt were united in the joint kingdoms of North and South; or the city-states of Sumeria came ultimately to be united under Sargon of Akkad; or Mesopotamia as a whole was dominated in turn by Babylonia and Assyria. This is the centripetal or centralizing force, the concept of a unity with common purpose and common interests, of which in Europe analogies are to be seen in the Roman empire, the religious and intellectual dominance of the early Roman Church up to the Reformation, the Holy Roman Empire, the frustrated aim of Napoleon, and the idea underlying the League of Nations and the United Nations Organizations.

Secondly, the idea that, from the analogy of the ritually divine character and purpose of the kingship as assuring the prosperity and well-being of his subjects, even so a like beneficent being or beings, power or principle is behind the multifarious appearances and activities of the universe, by which the nature of this being or beings is revealed and unfolded to the understanding of man. Except in the heretical doctrine of Ikhnaton, this conception never quite attained to monotheism, but it did with the Persians lead to dualism, the principles of good and evil—Ormuzd and Ahriman—and as such passed over to the Greeks.

Here, then, it would seem, is the germ of the conception of the regulation of the universe as a revelation of the Divine purpose; but it was only among the Jews that polytheism, the Baals and Gods of the High Places, were rationalized into the doctrine of the one and only true God. For another doctrine—the brotherhood of man, which may be regarded as characteristic of modern civilization,—it is necessary to look to the contribution of Christianity and the influence thereupon of the philosophic conceptions of Stoic teaching.

European history is a struggle between East and West, the results of tribal migrations from Asia into Europe and their resurgence, when the extreme west is reached. This movement possibly began as far back as late Palaeolithic times and certainly in Neolithic. The migratory struggle in Europe reached its peak of highest intensity in the early centuries of the Christian era; but it is still going on.

Combined with the struggle of West against East is the attempt to integrate the whole or part of Europe. This is only one phase of a movement towards integration which goes back to the earliest stages of man's social history, as has been shown in dealing with Egypt and Mesopotamia.

In greater or less degree this movement runs throughout European history; for example, the various Protestant Leagues, the Roman Empire and the Roman Church. Most of these movements have been based on force, but the Pan-Germanic, Pan-Teutonic, Pan-Slavic and Pan-Turanian movements are examples in which race has been urged as the basis of union. This also was the sentimental aspect of the British Empire.

As against these movements towards integration, there have been the centrifugal forces, mostly nationalist. The Greek city-states have been taken as examples of the centrifugal sentiment. The centrifugal force or decentralizing in the British Empire was responsible for the passing of the Statute of Westminster, which brought the idea of imperialism to an end, and gave rise to the looser organization of the British Commonwealth of Nations. The importance of this conception, of centripetal and centrifugal forces at work in the development of civilization, is that it represents an effort towards the recognition of a universal brotherhood of man growing out of a normal development in the evolution of social organization and its frustrations.

In religion the spirit of freedom of thought, which in science had urged men to examine facts as a basis for the exercise of reason, led to an increasing reliance on the text of the Bible without the intervention of authority, and gave rise to Puritanism, which abrogated, or professed to abrogate, all formulas and ritual. Methodism in the middle of the eighteenth century was an attempt to rejuvenate ideas derivative from the Reformation, but which had lost their vitality in the churches, though they were inherent in the minds of the populace.

By the close of the seventeenth century, or thereabout, the impulse of the Renaissance towards original inquiry appears largely to have exhausted itself. The trend of thought was to reason upon the material that had been acquired, rather than to amass fresh stores

of fact. Hence the importance of thinkers like Voltaire and Rousseau, who bring a freshness of idea to bear upon the knowledge of their day. At the same time there is a certain priggishness and self-satisfaction in the thought of the eighteenth century. It was, however, intellectually an epoch of great importance, as it formulated general ideas of philosophy and social science, which were to be of the greatest moment.

With the rise of industrialism at the close of the eighteenth century and its great expansion in the nineteenth, social and political problems were forced on the attention of governments; their solution was perforce attempted along lines of consonance with the principles of the French Revolution, or rather in accordance with the development of general ideas, to which the Revolution was a premature attempt to give them practical effect.

From one point of view it may be said that everything in the development of modern civilization goes back to the freedom from authority and the liberty to examine facts for oneself which is the essence of scientific advancement. In Christian Europe this dates from the Reformation. Conversely, when once men began to examine evidence in a spirit of scientific inquiry, the claims of the ecclesiastical organization and the claim to be the sole interpreter of the facts of observation were bound to give way.

The distinctive cultural characters of what has been called Western Civilization are modern science and the Christian religion —one concerned with the cultivation of natural knowledge; the other with supernatural influences. Each has its own standards of human value and each is a vital factor in the shaping of the social structure. With the growth of Christianity, craftsmanship and the dignity of labour were rescued from the position to which they had been debased in earlier times and a new social philosophy was founded.

It cannot be said that the earliest Christians had much to do with the formation of this philosophy as a means of improving conditions of life, or providing a better early future for the human race. A strange blindness as to the possibility of either material or moral advancement pervades their teachings. This was a natural consequence of the belief that the old order was soon to be overthrown and be replaced by the new through catastrophic changes.

Though the first Christians were mostly people of the working class and had little education in a literary sense, yet there went on a process of assimilation by which the Church was preparing for the reception of the classical tradition, and for the formation of a new cultural type. Justin Martyr, for example, who lived in Ephesus and Rome in the second century and died a martyr of the Christian

faith, wrote a work in which he attempted to show that the doctrines were in harmony with the rational ideals of Greek philosophy.

This tendency to assimilate Hellenic thought reached its highest development in the school of Alexandria in the third century, and by the beginning of the fourth century classical culture had obtained a sure foothold within the Church. The reconciliation of the two ideals in the fourth and fifth centuries had a very important influence upon the outlook of the European mind. The revival of classical learning and the rhetorical tradition made possible the rise of modern European civilization.

During many centuries of deep ignorance and barbaric anarchy in Western Europe, the only centres of enlightenment were Christian monasteries in which the sacred scriptures were studied with devotional delight and used as standards of worthy ways of life. Their founders were missionaries who, like St. Paul, the first great missionary of Christ, carried a new gospel into many lands, and introduced the elements of Roman civilization into the greater part of barbarous Europe. In the fifth century, St. Patrick was the greatest of these apostles and through his religious vigour Ireland became one of the chief civilizing centres of the West. He made Latin the ecclesiastical language of the country and from his Irish monasteries missionaries went far and wide to use it in the diffusion of sacred and secular knowledge.

Ten centuries before that time, Gautama Buddha had founded a new philosophy which was adopted as a religion over a large part of India from Nepal. In the third century B.C. Buddhist missionaries took this religion into Ceylon, whence it spread to Burma, Siam, Indo-China, Turkistan, and other regions in the East. Between the fourth and seventh centuries Buddhism became an established religion in China, Korea, Japan and Tibet in one form or another, and though it is not so widely distributed as Christianity, it has now just as many millions of nominal followers. There were many Buddhist monks and monasteries in Asia when Christian missionaries and organizations began to influence the course of civilization in Europe.

Asceticism and mysticism are the most esteemed modes of life in Buddhism and other eastern religions. St. Anthony, the father of Christian monasticism, adopted this kind of life when in the third century he went to live as a hermit on a mountain near the Red Sea and attracted so many disciples that they became a secluded community with a monastery as its place of residence. As solitary hermits or in communities, "holy men" of this type detach themselves from everyday affairs of the world around them and represent super-human efforts to transcend the limitations of earthly

existence. They are always reverenced for their spiritual concentration, which becomes a standard of religious life in which aspirations of the human heart prevail over common animal appetites.

This type of monastic life prevailed in Northern and Middle Egypt when St. Pachomius (296–346, A.D.) founded on the Nile, near Dendera, a different type of monastery in which agricultural work was combined with Christian devotion under disciplinary rules. Other monasteries of the same kind were afterwards established and were constituted as the first Religious Order in the sense in which this term is now used.

Early in the sixth century, St. Benedict, after living for three years in a cave in solitary prayer and meditation, went with a band of disciples to Mount Cassino, where they built the famous monastery which became the centre of the Benedictine system that remained for several centuries the only form of monasticism in Western Europe, with the exception of Ireland. Excessive austerity was discouraged and devotional services occupied a shorter part of the day than in monasteries of the Eastern type, while greater attention was given to useful work and regulated study. The Benedictine monasteries thus became the chief civilizing agencies in Western Europe and combined religious faith with the primary needs of rural life in a truly sound system of law and order by which individual service sought no private gains but added to the common wealth of the community.

The Benedictine system did not constitute a Religious Order, as the monasteries in which its Rules were followed were not federated like those established in the tenth century and later. It did, however, depart from earlier organizations by making the monastic vocation communal rather than individualistic, as well as enjoining useful employment in addition to the exercise of religious devotion. It thus presented a strong and significant object lesson for social reform during a long period of darkness and instability, and assisted in regenerating civilized life in Western Europe.

The new civilization which emerged in the early Middle Ages was thus a religious creation, because it was based upon an ecclesiastical and not on a political unity. The only true citizenship open to the ordinary man was the citizenship of the Church, and this involved a deeper and wider loyalty than allegiance to the secular State. The bitterness of the attitude toward all peoples of other faiths, and the persecution through torture and death of anyone in Christendom who dared to question the control of his soul by ecclesiastical authority, detract greatly from the credit due to the Church for what it did for life and learning by the establishment of monasteries. The iniquities carried out in the name of Christ dishonoured His

Gospel and disgraced the divine grace invoked to justify them.

In insisting upon the importance of labour and the vanity of excessive asceticism, St. Benedict followed St. Basil (331–379) who introduced Pachomian monasticism into the Eastern Roman Empire. Greek and Slavonic monasticism are still essentially based upon the foundations established by St. Basil. The council convened at Nicea by the Emperor Constantine in 325 defined the Christian faith and condemned as heretics or infidels all who had not been received into the Church or who departed in any way from its accepted creeds.

In the calamitous period of European history which followed, there were various types of religious principles and practice, both pagan and Christian. The Teutonic tribes became followers of Arian of Alexandria, who denied that Christ was consubstantial with God, while Latin Christianity remained Catholic with the creed of St. Athanasius as the test of orthodoxy and the creed threatening extreme penalties to be suffered by all who would not accept it to save their bodies and souls.

In the eighth century, Islam, the new religion founded by Muhammad, when he left Mecca for Medina in 622 A.D., unified the Arab tribes who within a few years had subdued and occupied vast territories in both Europe and Asia. Arabia became entirely Muslim and no unbeliever was permitted to live in the country. Forty years after Muhammad's death the sacred Christian city of Constantinople, built by Constantine the Great upon the site of the old town of Byzantium, was assailed by the advancing Muslims, who within a century had extended the rule of the Arabs from Spain and Morocco in the West to India in the East. Jerusalem was captured in 637 A.D. but as the proselytizing zeal lost its fervour, pilgrimages to it and other Holy places were tolerated, and Christians suffered no greater persecutions from the Muslims than did those who did not accept the orthodox faith of the Western Church.

With the rise of the Turks, who had accepted Islam as their religion, a more aggressive attitude was taken towards Christianity and outrages were committed against pilgrims to Jerusalem, which was captured by the Turks from the Arabs in 1071. During the Crusades in the eleventh and thirteenth centuries the city and territories leading to it were taken and re-taken several times by followers of each of the two faiths, and there were fanatical outrages on both sides. The wars extended the power and authority of the Roman Church but they had little other influence upon cultural development. When Crusades were later undertaken against heretical sects in Western Europe, they impeded this civilizing growth instead of promoting its refinement.

The Arabs, with Islam as their religion, passed from simple nomadic conditions of life into organized communities with high ideals and purposes in the short period of a hundred years. In succeeding centuries, while Western Europe was ruled by monkish theology and learning was limited to knowledge of the past, the Arabian Empire became supreme in its social and scientific achievement. It took a thousand years for Europe to pass from barbarism into similar conditions of civilization.

When the Crusaders returned from the East they brought with them memories of places which for grandeur and pleasantness excelled to the highest degree anything they had previously known. They had seen cities with splendid palaces and miles of paved and lighted streets. There were many hospitals, public baths, colleges, academies and other centres of higher education; and everywhere science and the mechanical arts were held in the same high esteem as the fine arts of music, painting, sculpture and architecture. The revelation led to increased demands for products from the East and for higher standards of living among the ruling classes, but improvements were slow in coming and several centuries elapsed before the richness of city life in the West approached the civilized standards of the East.

Centuries before Constantinople replaced Rome as the capital of the Eastern Roman Empire and became the centre of Eastern Christendom, it was a famous Greek city, renowned for its beauty and prosperity. Byzantine civilization may be said to have had its roots set in oriental soil and to have been cultivated under Christian influence during its early stages of growth. It occupied a distinct stage in the history of cultural development during a period of general darkness and disturbance in Europe.

The Emperor Justinian, the Law Giver, subdued invaders of the Byzantine Empire and established imperial power in North Africa, Italy and a part of Spain. He was of barbarian extraction but became a Christian and was the builder in 538 of the magnificent church of St. Sophia, in Constantinople, where it still stands as a supreme example of Byzantine architecture. The Empire began, however, to decline in the seventh century, though Constantinople continued long afterwards to be the world's key-port for traffic between Europe and the Near East.

Modern European civilization may be said to have begun when the Empire fell finally before the Ottoman Turks, who stormed the city in 1453 and converted the Christian church of St. Sophia into a mosque for followers faithful to the new monotheistic religion of Islam. Four minarets were erected on the building and mosaics and images representative of saints and living forms were covered up or

removed as being idolatrous in character. This attitude of Muslims towards sacred symbols is thus opposed to that adopted in both Eastern and Western Christian Churches.

Differences between the doctrines of these two Churches mark different stages of cultural development in Europe. A doctrine which was condemned as heretical by both the Greek and Roman Churches is that associated with the name of the Syrian priest, Nestorius, who was consecrated patriarch of Constantinople in the year 428. As with Arians, the doctrine denied that divine and human natures were one in Christ and that Mary, his Mother, should be called the Mother of God. Nestorius was deposed by the Council of Ephesus in 431 and retired into a monastery at Antioch, from which he was afterwards banished.

Nestorianism as a form of the Christian religion continued to extend its influence after the death of its founder, and it became one of the main links between East and West. Before the end of the fifth century, there were Nestorian bishoprics as far as Herat in Afghanistan and Merv in Asiatic Russia; and in succeeding centuries Nestorian Christianity had established itself in the Near East of Turkey, the lands of the eastern Mediterranean and Egypt as well as the Middle East of Iraq, Persia, Afghanistan and Arabia, and had even penetrated into China of the Far East.

When the nomadic Arab tribes had been unified by Muhammad in the new religion of Islam and had overrun vast territories in Europe and Asia by conquest, they often found themselves among peoples possessing intellectual attainments and practical knowledge of a new kind, and they entered this new field with similar enthusiasm to that of their military ardour. They came into contact with the religion of Zoroaster in Persia, and with Mithraism and Greek and Latin Christianity, but tolerated such infidels so long as they paid tribute to their conquerors. Nestorian Christians translated a number of Greek works into Syriac during the fifth century, and later these versions were rendered by them in Arabic. Translations were also made direct into Arabic and they included not only works by Aristotle, Hippocrates, Galen, Ptolemy, Euclid and Archimedes, but also by Hindu authors, the Arabs having long had commercial contacts with India.

With the increase of these relationships came the adoption of the Indian numerical system of notation, which by the eighth century was being used for arithmetical calculations instead of the cumbrous Greek and Roman methods. By the end of the ninth century the Arabs had thus become acquainted with Greek masterpieces in geometry, mechanics and astronomy, and with Hindu works on algebra and arithmetic, including the decimal system. Arabic

numerals were introduced into Europe with the revival of learning in the thirteenth century, and by the end of the century figures, such as 1, 2, 3, were being widely used instead of Roman letters to express numbers and to facilitate calculations.

With these philosophic and useful treasures of learning from Greek and other sources as their intellectual capital, the Arabs used them with such wise and practical purposes that for six centuries they were in the van of civilization. Their religion of Islam permitted freedom of thought and scientific curiosity during a period when any such adventures into the realm of natural knowledge were regarded in Western Christendom as evil undertakings, to be denounced and repressed as heretical by ecclesiastical authorities. The Arabs cultivated observational and experimental science as well as extended the mathematical methods of the Greeks and Hindus, and with the Moors, who became Muslims after the Arab invasion of Morocco in the seventh century, made the cities of Spain brilliant centres of light, leading in the civilized world while the rest of Western Europe lived in conditions of barbarous darkness.

At all stages of these cultural developments, Jews cooperated with the Arabs in the extension of learning and the promotion of scientific and medical studies and industrial arts. The efflorescence of Arabian-Moorish culture reached its finest stage in the tenth century, when scholars from every country in Europe resorted to the renowned schools and libraries of Cordova, Toledo, Seville and other great cities and centres of science in Spain. The philosophers and physicians for whom Muslim Spain was famous were mainly Jews or of Jewish extraction.

With Hebrew as their common linguistic heritage wherever they went, and with wide knowledge of other foreign tongues, Jewish scholars formed the main intellectual bridge between the Greek, Arabic and Latin languages, and became the chief interpreters to Europe of Greco-Arab science. Greek texts were translated into Hebrew before they were rendered into Arabic and afterwards into Latin for Christian scholars. At Naples and in Provence, in addition to Toledo and other intellectual centres in Spain, these civilizing influences were encouraged, while at the same time the fields of Arabic science were made known to the western world.

After the tenth century, Arabic learning and science, with their spirit of inquiry and reasoning, began to influence other parts of Europe. Gerbert, who became Pope Sylvester II, visited the Spanish peninsula in the eleventh century, made original contributions to mathematics, and aroused suspicion of having associated with the devil by making a clock and an organ which was driven by steam. He also constructed terrestrial and celestial globes.

In the eleventh century, Adelard of Bath, a monk who studied in Spain, disguised as a Muslim, brought back a knowledge of Arab and Moorish science and translated into Latin a copy of Euclid's *Elements of Geometry*, which remained the standard work on this subject in Europe until the sixteenth century.

The observing and questioning spirit then began to take shape. Albertus Magnus (1193–1280) showed that the so-called gold of alchemy was turned into powder by fire, and he wrote thirty-eight large volumes on plant and animal forms and physiology, physics, mineralogy and many other branches of science. Michael Scot (1175–1232), who studied Arabic at Toledo, translated works of Aristotle from that language into Latin, and also wrote books on astrology, alchemy, physiognomy and similar subjects through which he became famous as a magician. He appears in this capacity in Dante's *Inferno* and in Sir Walter Scott's *Lay of the Last Minstrel*. Robert Grosseteste (1175–1253), a Suffolk peasant who became the head of the schools of learning at Oxford and Bishop of Lincoln, was a revered teacher of the questioning method of scientific study. His *Compendium Scientiarum* was not merely a collection of miscellaneous knowledge but also recorded original contributions made by him to mathematical and physical science.

Roger Bacon (1214–1294) was inspired by Grosseteste's attempts to apply mathematical methods to the study of physical phenomena and to break away from the philosophy prescribed by schools founded upon translations of Aristotle's works. He made frequent references to the scientific writings of his illustrious teacher and also to Peter de Maricourt of France, known as Peter Perigrinas, who in the thirteenth century made systematic studies of magnetism and constructed a compass with a graduated scale and pivoted needle. "Through experiment", said Bacon, "he gains knowledge of natural things—medical, chemical, indeed of everything in the heavens or earth".

This is the spirit of modern science and Roger Bacon was its devoted disciple three centuries before Francis Bacon became its constructive advocate in his system of a new experimental philosophy, the principles of which he formulated in his *Novum Organum*. Roger entered the Franciscan Order about 1247, but his protests against scholastic authority in natural philosophy, and his appeals to direct observation and experiment as being superior to sophistry as a means of arriving at natural truths, incurred the suspicion of his superiors and led to his being placed under close supervision.

Then and for long afterwards ecclesiastical authorities resented extensions of natural knowledge beyond the limits of the Holy Scriptures and classical literature bequeathed to them by ancient writers.

This heritage was accepted as an inalienable possession of beliefs

and knowledge, beyond the limits of which there was little desire to travel in fact or thought. Natural phenomena and events were submitted to the writings of ancient authors whose conclusions were taken as final and whose authority could not be questioned without doctrinal heresy: secular and sacred reasoning was fettered by credulity with regard to the supernatural, and science was regarded as a form of natural magic by medieval theologians. During the long period in which this attitude prevailed, there were few important advances in the field of factual knowledge, the explorations of which have determined the structure of Western Civilization. Astronomy, as the study of the heavens, continued to be associated with theology, but observations had to be interpreted in terms of orthodox Christian belief of the times, or be condemned.

These restrictions were not so rigorously applied to other branches of learning in which the clergy were the leaders in the construction of the Christian side of Western Civilization. Subjects were studied not as things in themselves but as elements of a divine plan of the life of man in a universe created for him. By their contributions to philosophy and scientific principles, the Greeks attained a supreme position in cultural history, with truth and beauty as objects of pursuit and standards of value. The Romans made usefulness the measure of service and absorbed little of the free and disinterested spirit of inquiry presented to them by Lucretius. Their particular aptitudes were towards planning and administration of practical achievements, rather than the pursuit of knowledge for its own sake. This Greco-Roman culture was fostered and developed by the Alexandrian school and inspired the scientific achievements of the Arabs, from whom the Latin world acquired it.

When by the fifth century Christian doctrine in Western Europe had reached a certain condition of stability, a new element in which verifiable knowledge was made subordinate to faith became the dominant cultural factor. Christian missionaries and monasteries were able to rescue Europe from complete barbarity by their message and work, even though their efforts were often crude and their methods sometimes became cruel and corrupt. Wherever they went they carried with them a part of Roman civilization, and combined piety with labour in a manner never before associated with religion. There were great scholars at the opening of this important epoch in the history of civilization, chief among them being St. Augustine of Hippo. His main works were written in the first quarter of the fifth century, and in one of them his endeavour was to reconcile the Christian idea of creation with the scientific principle of evolution—a subject which excited bitter controversy fourteen centuries later.

Another outstanding intellectual personality of this time was the Venerable Bede (673–735), who spent his life in the monasteries of Wearmouth and Jarrow and by his works earned the title of the Father of English History. In one of his early works—*De natura rerum*—based largely on the writings of Pliny and Isidore of Seville, he records personal observations and refers various phenomena to natural causes, in the spirit of an earnest seeker after scientific and historical truth. Alcuin or Albinus of York (735–804), who became abbot of the famous school and abbey of St. Martin in Tours, was the main agent in transmitting to the Franks the culture attained in English monasteries under Bede's guidance. He was entrusted by Charlemagne, King of the Franks and Emperor of the West, with the establishment of an educational system in the Empire under which public instruction was given in schools by State authority.

Charlemagne himself, in addition to being a great warrior, made his Empire the nursery of Western Civilization. He introduced a new system of weights and measures and a new calendar, condemned medical superstitions, and gave names to the points of the compass or the wind-rose. He was the inspiring leader of a new renaissance in Europe, as notable in some branches of learning as the Muslim movement, though not so distinctive in the realm of the natural sciences.

The subjects taught in the cloister schools founded in France by Charlemagne were the seven liberal arts: Grammar, rhetoric and dialectic or logic, arithmetic, geometry, music and astronomy, with theology added later. These became the educational elements of scholasticism—a system of teaching which combined ancient philosophy with Christian discipline. As already mentioned, Roger Bacon protested against these sovereign powers of the ancients and the schoolmen; but his works did not affect the expansion of their teaching, which attained its greatest strength in the thirteenth century under St. Thomas Aquinas and Duns Scotus, though these two philosophers differed greatly in their views as to the relationships between natural and theological knowledge.

Themes of this kind were the essence of most of the disputations between leading schoolmen, and they were taught and expressed in the words of classical or sacred authorities whose judgments might be elaborated but not contested. With the increase of positive knowledge, the problem of amalgamating faith with facts in a single system on a rational basis proved to be beyond the powers of the schoolmen and led to the decline and fall of scholasticism as a dominating educational force.

If there had been a greater body of free and active contributors to natural knowledge, the intellectual triumphs of the system would

have extended over a much wider field, and theological dogmatism would have had a less prominent place in it. By bringing the mass of Greek knowledge into living relation with medieval culture, philosophers of the thirteenth century created a new synthesis and exercised scientific thought in its construction. Within the limitations of their times they conceived an intelligible order of the universe on the basis of Greek ideas and from the point of view of Christian theology, but while they asserted the right of human reason, and their logic was sound, their vision did not extend far enough into the natural world to arrive at permanent principles relating to the repercussions of things and forces in it.

There are still people in enlightened as well as in backward countries who insist upon tying travellers on scientific roads to the Procrustean bed of customary dogmas, but leading scholars of both natural science and theology have abandoned the attempt to explain one in terms of the other and now recognize that the two systems follow different lines of development, each having its own standards of civilizing value. A docile as well as a devout mind is required for the acceptance of religious beliefs without qualification, and such a passive intellectual state is altogether contrary to the critical and expanding attitude presented by scientists towards human problems.

Western civilization had as its foundation the classical tradition of human studies, with language, literature, history and philosophy as its elements, and Christianity as a catalytic agent to combine them. It is far in advance of all other types of cultural development in the services rendered by scientific discovery and invention for the promotion and improvements of standards of life and for intellectual expansion. In these factors of civilization, science can justly claim full credit for progress, but the human or spiritual factor is the determining influence in life's equation. Western Civilization is a product of religion and science, but whether or not the principles of each of these civilizing forces can combine, in their respective fields of activity, to make this a Golden Age, is a problem for the solution of which both must accept responsibility, as trustees of the heritage of human knowledge and feeling.

XV

THE MACHINE AGE

THE machine age or period of civilization began in the eighteenth century. Its distinctive feature is the harnessing of natural sources of power, instead of men and domestic animals, to do the work. Ancient and modern types of civilization are separated from each other by an intermediate period known as the Middle Ages—a term often loosely used to cover the thousand years from 500 to 1500 A.D. This period from the sixth to the sixteenth centuries comprises medieval times, whatever the conditions of life and thought in it. Modern European or Western Civilization may, however, be said to have started to take shape in the tenth century, and through the use of the Latin language and the institution of Christian monasteries to have grown into its present pattern.

The foundations of what is known as modern civilization were thus laid eight centuries before the machine epoch opened and brought about revolutionary economic and social developments. The terms Stone Age and Iron Age are commonly used to mark stages of human culture in which tools and implements for the arts of peace or purposes of war were usually made from these materials. They are, however, only convenient divisions or stages of cultural development and often introduce, as well as leave out, other factors which determine the character and structure of society. This obviously applies also to the machine age; for modern labour-saving engines are used by primitive peoples as well as in more advanced urban communities.

The lever, the pulley and the wheel were known in the earliest civilized times and were the simple machines by which man multiplied his natural output of energy. He is, and always has been, devising contrivances to secure from Nature the best result with the least possible toil and by his endeavours to master the physical conditions which involve the penalty "in the sweat of thy face shalt thou eat bread". For the cultivation of the land to add to natural supplies he invented the digging-stick, the hoe and the plough. Pots were constructed in which to cook and store food, granaries built to preserve harvests, mortars and pestles worked by hand or by cattle, and then the rotary mill, driven by winds and water, became the corn-grinder.

In the making or embellishment of these things, the instruments

used are tools, whether knives, axes, hammers, drills or gravers. A tool may thus be defined as an implement to convey a total force directly to the material upon which it is used. A machine enables the direction and velocity of the applied force to be changed, but though it can be made to do work more quickly and with greater power, it cannot create force. Man is, however, distinguished from other living creatures in his creative powers, whether expressed in poetry or pictures or in the discovery of materials and their uses in the applied arts. When early man found that flints could be flaked, he made a discovery: when he constructed arrowheads and axes from this material, he became an inventor.

The inquiring and constructive instincts which lead to the discovery of useful properties of things on the Earth and in the heavens, and the principles of potential sources of power, are thus just as natural as any other human qualities. When primitive man used logs or simple boats to carry him down stream from one point to another, he was applying the energy of running water for transport, as it is done to-day for barges in tidal rivers and in water-mills. When he found that wind could also assist the movement of his canoe, he invented the sail and afterwards the sailing boat and the wind-mill. In all these contrivances natural sources of energy are used to perform mechanical work. An engine is a machine constructed to make natural forces render useful service; and it is therefore called a prime mover or agent which converts their power into work.

There were thus many implements, instruments and other ingenious mechanical devices in everyday use long before the industrial revolution began in the eighteenth century, among them being clocks, printing presses, spinning-wheels and looms. The key-note of the revolution was the use of new sources of energy to drive the machines. Energy is the capacity to do work, whether it is exerted by man or beast, wind or water, gravity or fire. Every living thing is continually converting energy from one form into another, with the heat and light of the Sun as the prime source. These radiations are trapped by plants and their energy is used to convert the elements in the air and soil into food and other products of growth. Man, and the ox and ass, dog, sheep and goat, camels, horses, reindeer and elephants used by him as beasts of burden, or for other purposes, absorb this energy in their foods and make it dynamic in their work.

In very early days use was made of other natural sources of energy in addition to those possessed by living creatures. Wind and water powers were the first of these inanimate agents of energy brought into action, and they had the advantage of not requiring food or similar consideration for the services rendered by them.

They were used to do work, and the value of their operations could be estimated in terms of man power or the working capacity of horse or ass or any other domesticated animal. In whatever form energy is obtained it is defined in mechanics as the capacity to do work, and kinetic energy is power possessed by a body in virtue of its motion. Work is done by the expenditure of energy and can be measured in foot-pounds, with a unit of 1 lb. being raised against gravity on the Earth's surface through a distance of 1 ft. For mechanical purposes the unit of work adopted is called a horse-power and is the power required to raise 33,000 lb., or nearly 15 cwt., through 1 ft. in 1 minute.

A wind strong enough to sway large branches of trees has a velocity of about twenty miles an hour and exerts a pressure of two pounds per square foot. This force can produce about 100 horse-power in a modern wind-mill, but its intermittent action greatly limits its practical service. There are, however, places on the Earth where much stronger winds are prevalent and these could become centres of industrial power development.

As a prime natural source of energy, water-power has many advantages over wind power and is now extensively used in a number of countries to produce electric currents for domestic and industrial purposes. Turbines with hydraulic pressure to drive them are now generally used instead of ordinary water-wheels. Water from a river or reservoir at a relatively high level is led by pipe-lines to vertical shafts at the bottom of which the turbines are fixed. Many millions of horse-power are obtained daily from this natural source of energy and are converted by dynamos into electrical power for use at the station or transmitted to distances hundreds of miles away for industrial or domestic use. This source of power, like those of coal and oil used as fuels to drive heat-engines, is derived indirectly from solar radiation, and the slave-labour done by it daily vastly exceeds that of the many millions of human beings and domestic animals in the world.

Tidal power has been used for centuries to drive water-wheels for grinding corn and other purposes. The introduction of modern turbines has enabled a few large schemes to be operated efficiently by this source of natural energy. The main problem is that of finding an economic way of getting a continuous supply of energy from a variable source by impounding tidal water in a suitable area. Early types of tidal mills cost more to construct and maintain this barrage than a steam or oil engine capable of producing the same power continuously, so they have fallen into disuse where these latter sources are available.

With modern turbines operating during both the rise and fall of

tidal water, efficient plants have been installed and others will no doubt be constructed. In Great Britain, for example, it is estimated that by the construction of a tidal basin in the estuary of the river Severn about half a million horse-power would be developed during ten hours daily, and there are practicable engineering schemes for making use of this power. It is highly probable that as the reserves of coal and oil decrease and their cost increases, tidal power will again be extensively used.

This source of power has existed ever since ocean waters came under the gravitational influence of the Sun and Moon and the Earth rotated under them. From the point of view of natural philosophy, the force which causes the movement always has been and always will be: however long the human race may last on the Earth or whatever its destiny, tidal effects will continue whether they are used or not. This is also true of all forms of matter and energy in the universe, the history of which is independent of man's physical relations to them.

The source of tidal energy is the rotation of the Earth in a direction of spin against the pulls of the Sun and Moon. It can easily be understood that a globe eight thousand miles in diameter, and spinning at such a rate that a point of the equator has a linear velocity of more than one thousand miles an hour, has tremendous angular momentum. The energy due to this rotation has been estimated at two thousand million horse-power. A minute fraction of this energy is represented in the movements of tidal currents in shallow seas and waves beating upon rock shores. The tides act as brakes upon a gigantic flywheel and tend to slow down the rotation of the Earth and increase, therefore, the length of the day by one second in 120,000 years—a period too long for even the difference of one second to be detected within historic time.

Volcanoes and other plutonic phenomena are sources of direct heat-energy which have long been used for domestic purposes in some parts of the Earth. At Lardarello, in Italy, bore-holes have been sunk which discharge large volumes of high-pressure steam, used by turbines to generate more than ten thousand horse-power. The immense amount of power available by deep boring in any part of the Earth is a natural reserve of energy which awaits engineering ingenuity to bring it into human service.

Heat was used as an agent of motion long before the introduction of the steam engine in the eighteenth century brought about a revolution in the industrial system and diverted craftsmanship from the home to the factory. Hero or Heron of Alexandria, who flourished near the beginning of the Christian era, used steam to drive a number of mechanical devices invented by him. Among these were a

simple fire-engine, a water-organ, machines on the "penny-in-the-slot" principle, and a toy turbine in which the reaction of jets of steam was used to produce rotary motion. Towards the end of the seventeenth century the pressure of expanding steam was used for the construction of engines to pump water from mines. Later, this force was combined with atmospheric pressure when the steam was condensed in a separate cylinder, in the invention of the rocking-beam pump still used at some pumping stations.

Though pumping-engines of this type were in use at a number of places in the first half of the eighteenth century, it was not until James Watt had combined scientific experiment with mechanical ingenuity that the first commercial steam engine became available for general use in 1769. Watt transformed a rude and imperfect steam engine into an efficient and powerful working machine suitable for use in mines, factories, mills and steamships, thereby adding greatly to the industrial output. For the driving of steam carriages or locomotives, high pressure engines without condensers are required and they were successfully built and developed by Richard Trevithick and the two Stephensons—father and son. By these inventions Great Britain became possessed of hundreds of thousands of mechanical slaves to work in the production of goods required for everyday use at home or abroad and to transport them from place to place on land or sea.

Since that time the number and power of steam engines have vastly increased throughout the world, first by the invention of compound or multiple expansion engines and then by the introduction of steam turbines. In compound engines steam at high pressure does work by expansion in one cylinder and then passes into a series of two, three or four additional cylinders, each of which takes out power from the successively lower pressures.

Steam turbines are of two types, one in which steam at high pressure is blown against blades fixed to a wheel thus causing the wheel to revolve rapidly, while the other type may be likened to a Catherine-wheel firework, or to rockets, in which propulsion is due not to direct impulse but to reaction, as in Heron's toy engine already mentioned. Both principles are combined in the steam turbines constructed by Sir Charles Parsons, whose name is rightly linked with that of Watt in the development of mechanical engineering through scientific knowledge and its practical application.

Parsons' steam turbines have brought about a revolution in the generation of power both ashore and afloat. They drive the screws of most great modern ships and also the dynamos at central stations where high power electricity is generated. For the production of the steam in these heat engines, the capital which is being used up is

that of coal or oil, until another natural source is found and can be efficiently tapped. A new power was brought into the service of man when Michael Faraday discovered in 1831 that electric currents could be generated by the expenditure of mechanical work, and that, conversely, electrical energy could be distributed to do mechanical work. All forms of electric dynamo in the world make use of this principle in their construction, whether they are driven by engines which derive their primary energy from the combustion of coal or oil, from running or falling water, or from any other natural store.

Combustion may take place slowly as in the ordinary burning of coal and oil, or explosively as with gunpowder or the activation of certain gases. In the seventeenth century an engine was devised in which the expansion of gases produced by the ignition of gunpowder was used to drive up a piston in a cylinder, but it never came into practical use. In every internal combustion engine, gas or oil is similarly fed into the engine cylinder with a regulated quantity of air, and the explosion of the gaseous mixture provides the driving force of the piston. There are usually four stages in the cycle of operations by which continuous motion is obtained from an engine of this type. First, the explosive mixture of gas or vapour and air is sucked into the cylinder, then it is compressed by the piston, which is pushed outwards by the expansive force of the ignited gases: the piston then moves inwards and completes the cycle by discharging the products of combustion into the exhaust pipe.

Whether energy is used for mechanical work by animals or by man, it is derived from effects of the Sun on the Earth. There would be no vegetation without the influence of the Sun's rays upon plant growth, and no forms of life. Food is the fuel of the animal engine just as coal and petrol are the fuels of steam and internal combustion engines. Coal is fossilized plant life, and petrol or gasoline was similarly stored up by plant cells and concentrated in sediment of the Earth's crust many millions of years before man appeared upon the Earth. The discovery of this accumulated source of energy is just as natural as the discovery that coal could be used as fuel for fires. If there be purpose in the creation of man and the endowments of his mind, it is reasonable to believe that in the course of his evolution he was intended to find and use this hidden treasure, even though he may destroy himself through it.

The energy received continually by the Earth from the Sun vastly exceeds that derived or derivable from all other natural sources combined. This reserve will never be exhausted while any form of life exists on our planet. The Earth itself is only a speck of matter

which intercepts less than a two-thousand-millionth part of the radiation emitted from the Sun's surface in all directions. The population of the world is about 2000 millions; so that numerically an individual life is the same fractional part of the whole human race as that of the Earth to the Sun's radiative influence. To believe that the Sun was specially created to give light and warmth and life to the Earth alone is, therefore, as presumptuous as it would be for a single person to think that all others existed for his advantage.

Every square yard of the Sun's surface, which is about twelve thousand times greater than the area of the Earth, continually radiates energy equal to about seventy thousand horse-power. The energy which thus reaches the Earth's highest atmospheric level is equivalent to about one and a half horse-power and is our "solar constant". This is defined as the number of calories or units of heat which would be received in one minute on a square centimetre of the Earth's surface with its plane at right angles to the rays of the Sun, after the absorption of rays by the Earth's atmosphere is taken into account.

The amount which strikes every square yard of land and sea surface varies with geographical aspects and seasons, but everywhere it greatly exceeds all other natural sources of power in use. In some regions, during the hours of bright sunlight, the energy received on an area of two square yards is equal to about one horse-power, and by using reflectors to catch the Sun's beams at their best and concentrate them, enough steam can be produced in suitable boilers to work a steam engine. At present only about three per cent. of the energy is made available for mechanical work by the use of solar engines, and until this efficiency is increased there is little promise of this source of power becoming industrially profitable.

Much more promising is the production of high temperatures by concentrating the solar energy with mirrors of the searchlight type to melt or sinter refractory substances. By this means, temperatures above the boiling point of iron have been obtained.

The extent to which natural sources of energy are used to do work is a measure of the power or position of a country under conditions of modern civilization. The burning of fuel to produce the power of steam engines, or of gases in the cylinders of internal combustion engines, is just as natural a chemical transformation of energy from one type to another as that by which man maintains life by making use of the energy radiated by the Sun to supply his daily physical needs. All things, animate and inanimate, vegetable and mineral, are conditioned by internal and external forces, some of which have been made available for human service. We know these forces by their influences and effects and can speculate upon their reactions

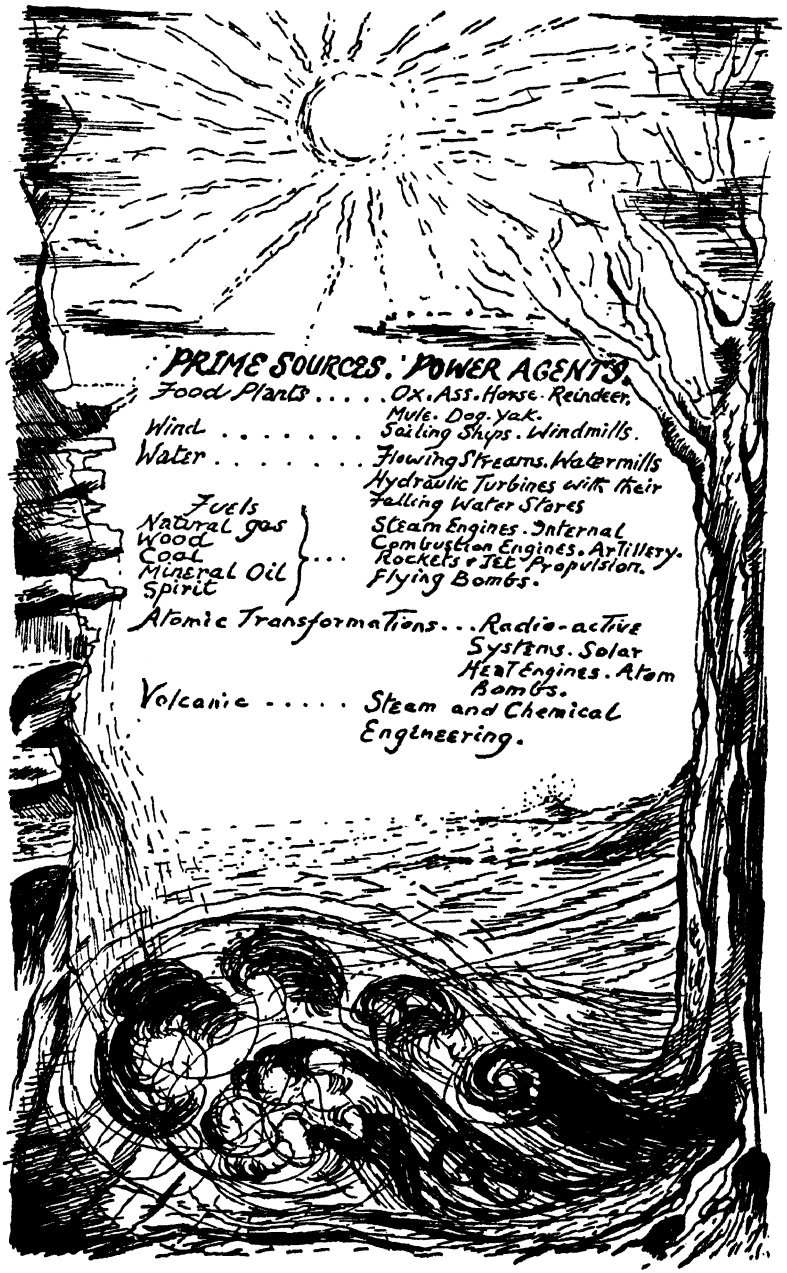
with matter in the past or the future, but the mystery of their creation passes human understanding. Man himself, however, possesses the creative urge and he has often followed the processes, and copied the patterns, of Nature.

Just as human powers and actions can be resolved into body and spirit, so the physical constitution of the universe consists of matter and energy—of atoms and radiation—convertible one into the other. The Sun and other heavenly bodies have their source of light and heat in sub-atomic transformations of this kind. Every square inch of the Sun's surface is continually emitting energy equivalent to fifty horse-power, and is losing mass, or getting lighter, at the same time. It is estimated that matter is thus being converted into energy at the rate of about 250 million tons every minute, or 260,000 million tons a day. In relation, however, to the quantity of matter in the Sun, the energy within it is so immense that this expenditure can go on for many millions of years without appreciable loss of capital in the form of mass.

The atoms of substances on the Earth are constituted like those on the Sun, and the same principle of equivalence of matter and energy holds good for them. The energy thus locked up in the building up of the structure of terrestrial atoms is almost inconceivable. By subjecting atoms contained in the chemical element uranium to particular physical conditions the energy in one pound of this matter is found to be equivalent to that obtained from the burning of about 1,500 tons of coal, or 250,000 gallons of fuel oil. In its explosive effects the same amount is equivalent to about 8,000 tons of T.N.T., and results in a temperature of many million degrees and pressures many million times greater than that of the Earth's atmosphere.

This inexhaustible source of power is now available for the welfare of mankind or for its degradation. History will, however, have to record that the power was first used to manufacture bombs as weapons of war of such terrifying intensity that the human heart trembles in apprehension of the future. Whether civilized man will use the powers given to him to promote physical and moral refinement of the human race or for its annihilation will, however, not be determined by the suppression of scientific discovery or the destruction of mechanical inventions, but by the growth of the sense of trusteeship of natural wealth for the welfare of his own and future generations.

It is natural to long for more peaceful and less exacting conditions of life than those which prevail in most modern cities and towns in this age of speed, hustle and noise; but there is no historical evidence to prove that, before the machine age, labouring people


PRIME SOURCES. POWER AGENTS.
Food Plants . . . . . Ox. Ass. Horse. Reindeer. Mule. Dog. Yak.
Wind . . . . . Sailing Ships. Windmills.
Water . . . . . Flowing Streams. Watermills. Hydraulic Turbines with their Falling Water Stores
Fuels
Natural gas
Wood
Coal
Mineral Oil
Spirit
. . . Steam Engines. Internal Combustion Engines. Artillery. Rockets & Jet Propulsion. Flying Bombs.
Atomic Transformations . . . Radio-active Systems. Solar Heat Engines. Atom Bombs.
Volcanic . . . . . Steam and Chemical Engineering.

in large communities were any happier than they are to-day. The primary needs of human life are food, clothing and shelter, and in the search of them man follows his natural instincts. He may be contented when these wants are supplied from natural or national resources without undue effort, but his condition is that of the beast in the field or a primitive cave-dweller. Measured by standards of material welfare, civilization begins when intelligence is used to increase these resources and to construct a cultural pattern.

Whenever natural sources of energy are made available for mechanical work by the use of wind or water power, or combustion of coal and oil, slave labourers of giant strength and untiring capacity enter the service of man and enable higher standards of living to be attained. It is not suggested for a moment that developments of this kind necessarily increase happiness or represent more than a single factor capable of contributing to progressive human welfare. As, however, man has a mind and the unique power of making useful or decorative things from the materials and forces in the world on which he is placed, it must be his duty to bring these gifts and talents into operation.

The sources of natural power available to a country or nation vary with geographical position and structure; the advantages derived from them depend upon the people. From this point of view, it is permissible to compare one country with another in terms of natural energy service.

In whatever way the power to do mechanical work is derived from natural sources, the device or process used is a gain of human strength. There is a limit to the amount of physical work a man can do daily, and to perform it he uses up fuel in the form of food. A community depending entirely upon human labour for the primary needs of life is, therefore, restricted in its powers of production and expansion unless it secures slave labour by military conquest. The use of wind and water powers provided mechanical slaves in very early times without degradation of human liberty.

In the Middle Ages the population of a country depended upon these sources of energy, and those possessed by man and domestic animals, for means of production. Some countries are in the same position to-day when their energy output from all sources is compared with their populations, and a measure can thus be obtained of the mechanical slave-power used for work. The United States and Great Britain, for example, each has from seventy to eighty times more power of this kind at the service of its peoples than has the sub-continent of India with its vastly greater population.

The gain of prosperity due to the harnessing of natural forces began with the introduction of the steam engine, and during the

past hundred years or so its measure in terms of energy has increased continuously through the mechanical production of electric power and the operation of internal combustion engines. By means of these agencies of transport and communication, the dimensions of time and space have been so greatly reduced that there are now no ends of the Earth, and sounds can go out into all lands sooner than they can be heard a few yards from the spot where they are produced. The range of the senses has thus been extended into realms almost divine, and by tapping natural sources of energy prime movers have been created having powers approaching those attributed to gods by primitive peoples.

When Prometheus of classical mythology stole fire from heaven for use on the Earth, Zeus condemned him to daily torture for his sacrilege. In heat engines, fire is stolen from the minerals of the Earth by modern Titans and its operative principle is chemical combustion, just as it has always been, whether used to boil water in primitive pots or to drive noisy locomotives by steam, and motor engines by explosive mixtures of gases. Prometheus was released by Hercules from Mount Caucasus, where he had been chained by the vengeful god; and as teacher of useful arts and benefactor of mankind became a culture-hero. For good or ill he may be said to stand for freedom from restraint of thought and action: for the urge to share in the creative spirit and the courage to conquer the forces which would deprive mankind of its terrestrial birthright.

Before the introduction of lucifer matches, fire was obtained by bringing strips of wood dipped into sulphuric acid into contact with an inflammable mixture containing chlorate of potash, and it was given the name "Promethean". The name of the demi-god may similarly be attached to the mechanical age in which heat-engines derive their energy from fire produced by chemical combustion and machines driven by them are used in the industrial arts. Though these mechanical robots are impressive in their design and perfection of movement, their creators cannot give to them the intelligent personality which marks craftsmanship. Their particular function is to increase the supplies of the primary needs of life—food, shelter and clothing—and to make their bounties widely available.

At all stages of civilization thought had to be given to the maintenance of these supplies, but, until machines provided almost unlimited slave-labour, the number of people who could be maintained in any country depended upon the products they could obtain from it or acquire by military conquest. Growth of mechanical power brings with it growth of prosperity of a country, whether

measured as wealth or as providing the material needs of an increased population.

These advances represent a distinct stage of cultural development in which creative ideas are combined with engineering skill. The scientific factor is that of additions to natural knowledge; while invention signifies an additional use of knowledge. Progress in these fields has made it possible to improve conditions of life everywhere, but it has been so rapid and revolutionary that it requires a new attitude towards knowledge in the structure of modern society.

When the principal occupations of a country are diverted from agriculture to manufacture—from craftwork at home in rural surroundings to labour in factories in thickly populated towns—human life is usually degraded. It is, however, as unreasonable to condemn progressive science and invention, for providing the means of increasing the production of supplies for the material needs of life and improving conditions of living, as it would be to blame instead of bless the Creator for good harvests or for making some countries richer in the fruits of the Earth than others.

There always has been, and always will be, dislocation and resentment when machines displace human labour, and rural communities are made subsidiary to urban in measures of trade and national prosperity. In recent years there has been much discussion of the ethical or social consequences of the application of mechanical and other scientific discoveries to industry. In the early days of the industrial revolution in England, there was little of the scientific spirit in industry. The discoveries of science were used with as much indifference to science as to humanity. The inventions of the eighteenth and early nineteenth centuries came from the workshop rather than from the scientific laboratory. Machines were devised and operations developed largely by trial and error methods, and academic research had few points of contact with industrial practice.

The characteristic of the present age is the utilization in industry of principles, properties and products revealed by scientific research, whether carried on solely in the pursuit of knowledge or with a practical purpose in mind. It is impracticable to repress scientific discovery and its applications everywhere; and to restrain it nationally would be worse than useless. Progress in these fields is as inevitable and relentless as the changes by which man has attained his biological status. Social structures and moral responsibilities have to be linked up closely with the new conditions of life if the mechanical age is to become worthy of a noble place in the history of civilization.

It is better for society to adjust its gears to climb this upward

path with its powers of production than to contemplate stopping the engine and to slip backward into the valley of "good old times", however strong the inclination may be to follow this course. Wisely used, scientific research and invention can be made to contribute to the well-being of the whole human race, but evolutionary social and economic adjustments are necessary to take advantage of these factors of progressive civilization.

It is easily possible to over-state the deadening effect of mechanization on the human mind. Much depends upon the individual and his character, qualities and interests. In the days before mechanization it was the deadening effect of manual labour of any kind, now contrasted with mechanization, which was blamed, and often not unjustly, for the inertia and the degeneracy of the masses in our population. They always have been and always will be inferior in some respects, unless they are leavened by the desire and the opportunity for self-development. Such an opportunity must now come in our modern civilization through the development of a regulated mechanization, which will not only give labour reasonable hours of rest and leisure, but will also promote thought and action in other fields. The most highly cultured society of which we have clear record, the Greek democracy of the fifth century B.C., was a society of such a type, in which leisure and opportunity for its employment in individual development were afforded to the citizens by what was then the equivalent of mechanization—the employment of slave labour.

XVI

SCIENCE AND SOVEREIGNTY IN WAR

In the most primitive times man had to acquire knowledge of the world of Nature around him in order to survive. The effort to secure food and shelter necessary for his existence demanded a never-ceasing exploitation of the resources of his environment for the progressive improvement of his material equipment—an equipment which he learned to turn against his fellow-man, no less than against the animal world upon which he preyed for food and clothing, or against which he must defend himself. But in this struggle, even more than on his personal prowess, his skill, and his knowledge of the habits of food plant and animal, man relied upon

his imagined understanding of, and his supposed power to control, the hidden causes of the nature and behaviour of the beings and objects of his world; in other words, his will to survive was rooted in magic. The magical beliefs of primitive man may seem to us vain and crude; yet in these blind gropings to probe causation in Nature may be seen the remote and humble beginnings of the urge to the understanding of things and forces of the universe, which is science.

Magic is associated with both religion and science in the development of man's conceptions of his relationships to natural phenomena and events. The belief that spells and incantations, in which secret words of power are recited, can change the established course of Nature is found in primitive thought everywhere. When the agency of divine beings is invoked by these means, to divert this course of natural events at a particular time or place for the promotion of material good or to avert disaster, magic merges into religion. Trust in such claims falls with the expansion of verifiable knowledge and religious thought. Then comes the recognition that the laws to which man has to submit or control are those of Nature, and that the study of them constitutes natural science. These laws relate only to the properties of material things and the effects of forces upon them.

By the discovery of their operation, man has become possessed of immense power, and he is free to use this to preserve or improve conditions of human life, as he always has been to distinguish between what is good for his existence and what are poisonous products of the world around him. From birth to death he has to defend himself against the many natural enemies which surround him wherever he is, or submit to be destroyed by them. He came into the world as a child beset with dangers, and under primitive conditions of life is still a victim of their aggressions.

Civilized man has, however, become a giant in his powers of meeting these attacks of naturally-created things and forces, and has learnt how to subdue and overcome some of them, though they still demand the sacrifice of millions of human lives annually. With this knowledge has come the creation of artificial devices of destruction as antagonistic to the development of the human race as the natural processes over which a certain measure of control has been acquired. While man has been learning how to control Nature he is still in the position of a child in his attitude and outlook towards the dangers which now encompass him and has not realized that his duty is to overcome them, as he has always had to do to survive the perils of the natural world in which he is placed.

This world has agents of destruction far more ingenious and

effective than any contrivances devised by human inventors. Man has, however, not been content to submit to suffer disease and death from these natural enemies but has battled with them; and scientific knowledge has given him the power of conquest over many of them. The same spirit is required to meet and avert the dangers to civilization created artificially, instead of pleading pathetically that they ought not to be put within his reach because he is still a child in wisdom.

At every stage of civilization there have been conflicts between communities for one reason or another, and all available resources of men and material have been used by the adversaries for their armed forces. This is as true of the tools and machines used in warfare by primitive peoples, as it is of the weapons which have been placed at the disposal of the modern world by the application of scientific knowledge to invention. In the three periods of savagery, barbarism and civilization which mark the stages of development of human societies, advances in these fields have been used to establish authority by resort to force. In physical strength man is poorly endowed compared with many wild animals, but he has increased his power over them by various artifices and made some of them his obedient slaves, while others he hunts for food or kills for sport.

The tools first used for these purposes were held in the hand, the club being the most primitive form. In course of time, this is superseded by the knife, dagger, sword and battle-axe, all of them gripped by the hand. Projectiles belong to another class of artificial weapon, the missiles being thrown directly by the hand and arm as stones, boomerangs, javelins and knives, or by simple machines as with the bow-and-arrow and the blow-tube. With the invention of the cross-bow an arrow-throwing machine-gun became a war engine. Similarly, the blow-tube was the prototype of the air-gun and of all other guns and artillery in which the release of the force of compressed gases is used to throw bullets or shells to a distance. The same explosive power comes into action when hand grenades are used at closer contacts instead of stones as weapons of war.

In the beginning the various instruments invented to capture or kill large and hostile animals enabled men to assume dominion over them. The war was against the animal kingdom, and motives and methods of attack or defence were patterned on those of jungle life. It is unusual for groups of the same species to organize attacks upon one another, though they will repel intruders upon their particular territories. From conditions of savagery to those of modern civilization there have, however, been trials of strength between different tribes and peoples. Neither courage nor righteousness of a cause, nor numbers, can prevail in such appeals to the

arbitrament of force without superior equipment in the physical weapons of warfare.

The possession of the most effective means of ensuring supremacy in conflicts between tribes or nations is, therefore, the prime factor of equipment for war. In the strategy of preparation for battle and the tactics of the fighting, the weapons—natural or artificial—available for offence or defence have to be given first consideration. For many centuries the only weapons used were those invented to attain control over the animal kingdom, but with increased scientific knowledge engineering became an essential part of the art of war, until training in the manipulation and disposition of machines has to dominate all other considerations.

War has always been an incentive to the use of devices to subjugate opposed armed forces; at every stage of civilization the weapons employed reflect the position of the industrial arts. These have advanced with the knowledge of the natural properties of things from the times when prehistoric man found that he could make cutting and piercing implements from flints, and thus began a new industry, through the bow-and-arrow period to gunpowder and modern high explosives and their use in war machines.

That heat is evolved when lime is slaked to prepare mortar was known ages before it was applied to the construction of a weapon of war. An architect named Callincus, who flourished in Constantinople in the seventh century, used this property in his invention of the first flame-thrower. His incendiary mixture probably consisted of quicklime, naphtha, pitch and sulphur, but the secret of its composition was jealously guarded. The mixture was projected from a tube and was ignited by a jet from a water-hose playing upon it at the same time, the necessary heat being derived from this process of slaking. For this reason it was called wet-fire or sea-fire, but is better known as Greek-fire.

The heat produced when quicklime is wetted in this way is sufficient to kindle gunpowder—another mixture of natural substances each of which was discovered long before it became a munition of war. The constituents of gunpowder are nitre or saltpetre, sulphur and charcoal, all of which have been known from very remote times. Roger Bacon was acquainted with this recipe, but he was not the originator of it. He did, however, refer to a powder which had its explosive power increased when enclosed in a container of solid material, and this is the principle used in gunnery. It was not until the fourteenth century that gunpowder was used in firearms; and this invention was made in Western Europe. The Chinese may have used gunpowder in hand grenades and rockets a couple of centuries earlier, but not in guns.

When gunpowder became a battle weapon there was the same resentment against its use in this way as there is to-day against the contrivances which further discoveries and inventions have placed in the hands of civilized peoples.

The arquebus, from which the musket was developed, was carried into the field of battle as a weapon for close fighting and was first used as an infantry firearm in the early part of the sixteenth century. The gun was supported on a rest or suspended from a hook and was the predecessor of the musket, and also, in its portability and use, of the modern machine-gun. The feeling that to use such firearms was dishonourable and contrary to the code of war was of the same kind as that aroused by the introduction of every new means of overcoming enemy forces. In his play, *King Henry IV*, Shakespeare makes Hotspur express this humanistic sentiment in the words:

> "And that it was great pity, so it was,
> That villanous saltpetre should be digg'd
> Out of the bowels of the harmless earth
> Which many a good tall fellow had destroy'd
> So cowardly; and but for these vile guns
> He would himself have been a soldier".

The use of gunpowder in firearms assisted to bring about changes in the social and political structure of Europe. It freed the people from the domination of the barons in the Middle Ages. Cannon as the arm of royalty destroyed feudalism. The castles of the barons could not hold out against powder and shot, and came under royal supremacy; while the musket, against which the armour was no longer proof, destroyed the ascendancy of the knight on the battle field. Cavalry had to yield to infantry armed with mechanical weapons; and the horse, which was used for centuries in terrifying charges on the field of battle, has now been superseded by armoured cars and tanks which are mobile forces capable of crushing everything in their path.

These changes began with the use of firearms in the fourteenth century, based upon the use of gunpowder as an explosive. The desire or need of nations to possess armed forces has led to the development of weapons of war to the present menacing stage. Early firearms were very crude and their use in warfare cannot be rightly described as revolutionary. They marked the beginning of an evolution of a new means of propelling missiles, the efficiency of which has been increased by many inventions based upon the same principle. These became possible through increase of knowledge

of the intrinsic properties of things and their practical application. Progress in the manufacture of munitions of war is an integral part of industrial development as a whole, and the encouragement given to it is determined by the intentions or needs of human societies.

Long after the introduction of firearms, lack of supplies of materials or of mechanical ingenuity deprived them of their full efficiency on the field of battle in comparison with bows and arrows, even though their invention was condemned as degrading to the art of war. It should, however, be remembered that the use of horses and elephants in warfare was just as novel and at the time was regarded as inhuman by vanquished peoples. Even the use of the crossbow came under an interdict in the twelfth century, when the Lateran Council of that time forbade its use except against infidels as a weapon "hateful to God and unfit for Christians". The prohibition was futile, and the crossbow continued in use in Europe until the middle of the seventeenth century. A century later, the great scientist and inventor, Benjamin Franklin, seriously contemplated a return to the use of bows and arrows in the American War of Independence because of the lack of supplies of materials to make gunpowder for the firearms of the army.

Knowledge of natural processes and forces has extended so greatly since those days that the problem now is not how to obtain explosive substances but how their use should be restricted. This object cannot be achieved by suppressing scientific inquiry, whether pursued purely for the sake of acquiring knowledge or for practical purposes. Everything that is known of the properties of substances is the result of experience, which when precisely expressed is science. The discovery that a mixture of nitre, sulphur and charcoal exploded suddenly on ignition belongs, therefore, to the history of science. It was first applied to the manufacture of fire-crackers and later to firearms. By substituting other compounds for nitre in the mixture, gunpowder develops into T.N.T. and other high explosives.

The uses made of explosive properties of mixtures of this or any other type are not determined by scientists but by social needs or necessities. The saying that "Art imitates Nature and necessity is the mother of invention" may thus be aptly applied to the use of scientific discoveries in the manufacture of weapons of war.

The fact is that the ultimate effect of a scientific discovery depends upon the nature of the demands of the community for its practical service, whether for warfare or for human welfare. The familiar fatty oil called glycerin, which has now many uses, was known sixty years before studies of its constitution led to the incidental discovery of the highly explosive compound, nitro-glycerin, a century ago. This remained merely an interesting chemical preparation until

about fifteen years later, when Nobel found that dynamite, gelignite and similar explosives could be manufactured by mixing it with certain absorbent substances. It is unreasonable to suggest that scientific inquiries into the nature and powers of the world around us should be repressed, and impracticable to define the stage at which the trail of academic science passes into the industrial field.

When an explosive is ignited or decomposed by a detonator, energy is released which can be used to propel shells, scatter the materials of bombs, or as blasting charges for engineering purposes. In each case the heat evolved is due to rearrangements of the atoms in the explosive and is the result of chemical change brought about by a certain stimulus. Every atom has a central part or nucleus, the sub-atomic constituents of which are held together with such force that when they are made to break up tremendous energy is released. This energy takes the form of light and heat when an atomic bomb explodes, and both are immensely higher in intensity that can be obtained by chemical combustion of any kind.

When it became known to scientists that this terrific power was locked up in the heart of every atom, they were well aware of the revolutionary effects its release would have upon the course of civilization. Prof. F. Soddy, who was responsible with Lord Rutherford for the original conception of atomic disintegration and the energy set free in the process, foretold that the first use which would be made of the discovery would be to manufacture devastating bombs. H. G. Wells, with the far-seeing vision of a scientific prophet, gave a graphic picture of what might be expected from regenerative atomic disruption in his novel *The World Set Free*, published in 1914.

These were warnings to civilized peoples against the use of the new "fire" to start conflagrations, but they were unheeded when the "necessities" of war led to the manufacture of atomic bombs. Scientists as citizens were recruited or conscripted to construct these deadly weapons, but they are no more to be condemned than any other makers of munitions of war. While the position of a nation in the scale of civilization is measured in terms of power politics, every available force will be used to ensure supremacy whether the cause of conflict is good or evil. War itself can never be anything but cruel and barbarous, and in total war there is no chivalry.

This is the order of the natural world, where the battle is to the strong and the race to the swift. With the introduction of moral laws the human race acquired a new attitude and outlook, and instituted rules of life and conduct of a higher kind than those prevailing in the purely animal kingdom. In its best sense, civilization is a process of refinement of these rules associated with the pursuit of truth and righteousness in diverse fields and in works

expressing these attributes. The moral codes of communities differ from time to time and from region to region. While they bind the members of one group together they separate it from others; so that while murder with malice is condemned and punished within a group, it becomes a lawful act when tribal, national or religious causes come into conflict, and the force of arms is used to ensure supremacy.

We have far to go before the moral laws which determine the rights and duties of members of a community are extended to bind the peoples of the world together for their common welfare. Civilization has now reached such a stage of power that an international understanding is imperative to preserve modern peoples from self-destruction. The indiscriminate slaughter of men, women and children and the devastation of their homes over an area of several square miles by turning a switch has made modern warfare a mockery of the highest human values and an insult to the throbbing human heart. The day is past when crimes of this kind were sanctioned in the name of religion and regarded as sacred. Man himself has acquired powers approaching those attributed to divinities in earlier days of civilization. At the same time there has been an incipient growth of tenderness of heart and other virtues which separate civilized man from other living creatures and from savagery.

All great religions have assisted in the promotion of these human characteristics, each in its way and by its own methods. As a social force every religion binds its followers together for their common good and inspires a loyalty which transcends any other incentive to action. The value of a religion to civilized life is, however, not now to be measured by attachment to a particular faith but by works to make this life progressively fuller and richer whether as spiritual preparation for another state of existence or not.

In modern times the particularist religious spirit has been diverted into the channel of nationalism, with sovereign States as the binding loyalty instead of sacred faiths. The hope for the future is the efforts being made to bring these States together for their common welfare and the good of the world. The ideal of federation by consent instead of by compulsion, based upon the conditions of modern civilization, by which all parts of the world have been brought together for communication and exchange of goods and services, appeals to an ever-increasing number of citizens who are not content to rest in the particular but want to pass to the international in social purposes and moral laws. To such, neither restrictions of national or racial distinction, nor differences between creeds, can weigh in the balance against the moral principles explicit or implied in all the higher forms of religion.

In the scale of development of human society, war has played a useful and, biologically speaking, a necessary part. Civilization involves, however, something more than natural processes in which the struggle for existence is purely physical. It is measured by standards of value belonging exclusively to the human race and represents achievements of the mind rather than specifically animal qualities. In this cultural growth war is a catastrophe, comparable to a great earthquake or other convulsion of Nature, but only incidental to the development which is continually going on in all forms of life.

Even if it is conceded that use of the fighting instinct of man has promoted the strength of his body and disciplined his mind, or that it encourages supreme self-sacrifice in support of high ideals, the mass destruction of whole communities in organized warfare must degrade rather than promote whatever is divine in human nature. The spiritual evolution of man, as represented by all that is best in civilization throughout the ages, and as inspired by the most exalted religious and ethical teachers, has not proceeded in its upward course through war, but in spite of it; and it is in the belief in its further development that hope may be found for the future.

XVII

PROGRESS AND PERCEPTIVE HUMANISM

PROGRESS means a movement forward or an advance and therefore implies a starting-point and a goal. When humanity emerged from its sub-human ancestry, its inherited instincts began to have their impulses determined by a reasoning faculty and it became possible to acquire and accumulate knowledge to be handed down from one generation to another. In this respect, therefore, the human race can be said to mark a distinct stage in the evolution of life, and its advances of knowledge in any direction to represent progress.

All such advances originate in new concepts or ideas which may or may not take material shape. Every new idea is, however, a stimulus to further intellectual expansion or practical endeavour, and civilization is the record of their development. Measured by the means of increasing the material welfare of mankind, science and

invention may claim always to have led the way. The laws or principles they discover and apply are additions to knowledge by which conditions of life can be improved in this world during the short period of occupation by the human race. What is our destiny here we do not know, but while we are here it is our obvious duty to do everything in our power to raise standards of living and find out at the same time the relation of our small planet to the many millions of other bodies in the physical universe.

The moral law is apprehended by a different set of experiences from that of natural science. Recognition of its influence as well as of utility of knowledge determines the progress of civilization. In each case the aim must be the attainment of the highest good on this Earth whatever our ultimate destiny may be. Goodness, truth and beauty are abstract ideas appealing in diverse ways and subjects according to attitudes of mind, but appreciation of their qualities is not excluded from the field of natural science any more than it is from the other elements which constitute human progress.

Intellectual expansion and the forms in which it is expressed are distinctive attributes of human nature and elements of progressive development. When the Sumerians became urbanized nearly six thousand years ago they found it necessary to introduce seals and clay sealings as guarantees of authenticity of commercial contracts and legal obligations. With these seals they developed a system of pictographic writing on clay tablets which evolved into the cuneiform script. As the temple was the centre of the Sumerian civic organization, it was also, through the development of writing, the cultural centre where knowledge was accumulated and used. The inscribed seal had a most important effect on the development of art, while the necessity for a dignified and fitting home for the god led to advance in style in building worthy of the name of architecture, to which the use of mud-brick could have contributed in no other way.

Drawings provide a universal means of representing objects, and their characters also convey individual or composite emotions and meaning. Many early forms of writing are conventional characters, developed from pictographs of this kind; and, out of these conventionalized marks, alphabets were constructed or characters were combined to represent syllables. All human beings express certain emotions, such as anger and fear, by much the same sounds, signs and gestures, and all can interpret simple picture writing, as all can understand the meanings of actions reproduced in modern moving pictures, silent or sound. There are, however, many conventionalized forms of characters to represent these sounds and

thoughts by written or printed words, and these combinations make up the many languages of the world. Pictographs or ideographs thus evolve into symbols representing gestures and sounds, and then into alphabets, the letters of which are combined in words to convey ideas from one place or time on the world to another, however far or long they may be separated.

Sounds were combined to express emotional feelings in the earliest civilized times, but the history of the art of music cannot be traced like that of literature, because no musical compositions from those times have had their forms or contents preserved. While, therefore, the contribution of a people or a period to the expansion of the human mind can be found in its literary records, and comparisons made between them on a scale of refinement, there is no known relationship between early and modern practices of the musical art. The melodies of primitive peoples to-day do, however, afford an indication of rudimentary combinations of sounds, and this folk-music has its own standards of excellence. Progress in music as an art, like that of literature, is in the exalted combination of the notes of a chromatic scale into a composition which arouses in its readers or listeners the emotional feelings which their writer wishes to convey. Fertility of creative ideas and the forms to which these give shape are the measures by which progress in all these arts of expression may be judged.

Increase of opportunities to read and hear what is thought or said in words or music is of even greater importance in the history of civilization than the works themselves. This began with the production of books in which raised letters or other characters were impressed with ink or other pigment upon the pages. Much of the early printing was done with page blocks of this kind; and the same plan is adopted to-day in the printing of pages from stereotype plates. The use of movable type was first introduced by a Chinese alchemist and inventor, Pi Sheng, in the eleventh century. He used type made of baked clay and experimented also with wooden type. A later improvement made in China was to use tin for the movable type. Early in the fourteenth century movable types were made in Europe of wood, tin and lead, but the modern art of typography may be said to have begun when in 1454 Johann Gutenberg issued, from his printing press at Mainz, books printed from types cast in a mould.

From a cultural point of view, the value of the invention was in the extension of opportunities of acquiring knowledge through book-learning. There were literary works and libraries in Assyria, Babylonia, Egypt and China in very early times, but each had to be separately written by hand. A book is a collection of scripts joined

together to form an organic whole so as to be portable. The first books may thus be said to be those written on papyrus in ancient Egypt.

Several rolls of this kind, with columns of hieratic writing done about 2500 B.C., have been found in tombs and are preserved in national museums. They are samples of many early Egyptian writings of a didactic and moral character, apart from religious spells and praises of the divine. Most of this secular and sacred literature preserved on rolls of papyri were made for school use by young scholar-scribes. There were wonder-tales, romances, humorous and gruesome stories, moral admonitions, of worldly wisdom and devotional conduct towards divine influences, as characteristic of human life and its spirit in the East five thousand years ago as are the literatures of classical and modern times.

The invention of mechanical printing, and the use of paper instead of papyrus, made it possible to produce the many millions of books now in our libraries, and for the knowledge and wisdom of all peoples to be made available throughout the civilized world. It is in the extension of this intellectual influence and the continuous development of processes of reproduction that the art of printing has reached the high position which it occupies to-day as a cultural force.

In so far as art, literature and music are expressions of the human spirit as well as reactions to conditions of life, any agency which multiplies their points of contact may justly be said to aid the progress of the race by expanding the outlook. This is what was done when printing presses converted the small corps of transcribers into a great mechanized force in the front line of civilization. The advance was in the apparatus for manifolding literary compositions and thus gave wider range to the light of the torch of learning.

The value of devices for reproducing words and sounds, written or spoken, lies therefore in the increased range of communication and the approach to truth attained. By these standards the telephone, microphone, thermionic valves, and other scientific instruments used to record and transmit scenes and sounds in silent and speaking films, must be acknowledged to have reached high degrees of perfection. It is sometimes suggested that this type of mechanization induces a passive state of mind and leads to mental atrophy instead of stimulating intelligence. These effects can, however, easily be exaggerated. In any event, the character, qualities and interests of minds receiving any messages determine whether attention is given to them or not.

Any failure to use the gramophone, radio and the cinema as an educative and cultural influence is due to the material presented

and not to the scientific instruments used. Both cinema and wireless now reach millions, where formerly the theatre, music and literature influenced hundreds, or it may be only tens. The effect is to be seen around us everywhere in daily life in a raising of the general cultural level. Nor is individual performance likely to be seriously affected. Photography and the gramophone were, it was feared, to put an end in turn to painting and music. Both have helped the development of these arts and the understanding of their principles, while as regards the individual executant they may possibly have eliminated a few who never would have attained perhaps even a mediocre competence.

Even if the voices and words of the greatest men and women of past times had been reproduced for the enlightenment of posterity, their effects would be no greater than those recorded and presented by modern methods. As expressions of the human spirit, art and literature are concerned primarily with the eternal verities of life and, like religion, may reach supreme standards of excellence at any epoch. In the fourth and fifth centuries before the Christian era, the works produced by the artistic and literary genius of the Greeks are masterpieces which will command admiration for all time; and ancient Egypt and Assyria, India and China, as well as Rome, each had its golden age of artistic and literary culture.

In Western Europe architecture, painting and poetry have similarly reached summit levels of excellence at various epochs and then declined. Progress in any of these arts of expression can be only in the richness of creative ideas, and this store does not increase with the ages but is essentially an individual possession. Artists may aspire to emulate the paintings of Raphael or Leonardo da Vinci, but they cannot use the works themselves as canvases upon which to add their own conceptions. Science, however, differs from the fine arts in the fact that every discovery extends the boundaries of knowledge and may be the starting point of further progress.

In the study of man and his activities three types of cultural development may thus be recognized; and they are all measured by different standards. In the fine arts the imaginative qualities of the mind appeal primarily to the emotions through stimulation of the æsthetic judgment; material culture is the province of the mechanical arts; and science—the domain of reason—is systematic and formulated knowledge in all fields of human understanding—natural, moral, social and political.

Natural science, or natural philosophy, is only one division of science as thus defined, yet, by general usage, the single word now signifies organized natural knowledge. The history of civilization from this point of view is a history of intellectual development in

which science has been the chief factor in changing habits of thought from superficial observation and speculative and anthropomorphic theories of causation to clear concepts, rational conclusions, and progressive principles in the advancement of man and society.

As progress in science is usually measured by practical applications to social structures, the general view in literary and other intellectual circles is that men of science are insensitive to beauty and incapable of deep emotion. They are believed to be blind to everything that makes life worth living to other people, and to know nothing of the artist's raptures or of the hopes and despairs of passionate natures. This view is perhaps not so general to-day as it was formerly, when science was commonly associated with materialistic philosophy and its ends were regarded as being purely utilitarian. An increasing number of people now realize that the conception of a great scientific theory may be as significant an achievement, as high an activity, as the creation of a great work of pure literature.

The change of attitude toward science is connected with the fact that mechanistic principles no longer dominate scientific thought. It is refreshing to the mind and hopeful for intellectual progress to know that science and philosophy are finding closer contacts than were encouraged in Victorian days. The multitudinous avenues along which science has developed have increased a thousandfold its points of contact with the unknown. To account for the many and diverse values which confront it, the scientific mind has had to enlist the support of methods other than those which made the laboratory supreme. Studies of the atom and of the universe have made metaphysics an essential part of physical theory, and philosophic speculations have suggested and assisted profitable lines of inquiry in practical fields.

Experimental work in physics has led to theoretical conceptions which suggest that the movements of atoms and electrons cannot be explained by mechanical models, and are just as indeterminate as human action. What was formerly purely metaphysical speculation has thus become a principle of natural philosophy. Developments in atomic physics seem to rule out the mechanical idea of determinism in Nature, and the acceptance of this view brings physical theory into the field of discussion of the philosophical and theological aspects of free-will and determinism, or of the associated doctrine of predestination.

During the past fifty years the scope of scientific thought has been greatly extended. Mechanical principles are still usefully employed to describe natural structures and processes, but not to explain

them. The membrane between the exact and the descriptive sciences —between philosophy and science—has been dissolved, and a sounder and more philosophic view of mechanism in Nature is now taken. This change has been brought about by modern work, and conceptions in the field of physical science and biological thought has been profoundly affected by it.

If mechanism is understood, not as the explanation of natural forces and events but as a description of them in simple language, physics, chemistry and biology are reduced to the same terms. For the understanding of the forms and movements of living things, the mind may construct different pictures from those which seem to represent conditions in inorganic Nature, but in both fields it must be remembered that they represent purely conceptual inventions. Scientific knowledge has advanced through such conceptions; and so long as the limitations inherent in them are accepted, they may be used to explore the machinery of life and the universe.

The urge to discover and disclose the ways of working of things in the world upon which mankind finds itself is just as natural and noble as that which seeks spiritual communion with their origin. It leads beyond the field of sensory experience into the realm of the spirit, which as moral realism is vital in every religion. While, however, the purpose of science is to press forward to the discovery of new truths, that of religion is to protect and maintain belief in the origin and end of natural processes. Both are founded upon instinctive elements in human nature, but with different standards of value by which to measure progress. The common factor of each is the pursuit of truth, but while science advances by unveiling natural mysteries, religion is largely concerned with the supernatural, for the existence of which there can be no rational proof.

While, therefore, science justifies itself by works, the progress of a religious faith is measured by increase of instinctive consciousness in its truth, as expressed in spiritual doctrines and practices pertaining to them. Each religion has its own ways and means of approaching divine truth and each claims exclusive possession of the key to it. The best plan is to think of these diverse faiths as threads to be woven in time into a single rope connecting Earth with Heaven, or mind with matter. This, however, implies the abandonment by each dogmatic religion of the claim to unique revealed truth and its special divine relationships with particular communities.

Every religion demands worship of supreme and unchanging attributes of perfection. The final goal can never be attained, yet faith in its existence makes religion a vital force in every society and a stimulus to high endeavour. In form, an act of faith expresses

a constant orientation of the mind of man throughout his history, from the purblind gropings of primitive man in his attempts to explain the happenings of the physical world around him to the highest forms of religion and the speculations of philosophers, such as Socrates and Plato, and the modern theistic systems which find in scientific hypothesis and metaphysical theory a gradual unfolding of the divine purpose believed to underlie the phenomena of the material universe.

It follows then that if the form, an act of faith, is constant in religious belief—if it can be regarded as evolving (the commonsense view, but not necessarily the anthropological view)—it is not the form but the content that develops. If we select a monotheistic faith as the highest development of religious belief, the content of an act of faith can be shown to progress from a belief in a vaguely conceived, but powerful, assemblage of spirits, embodied in the whole world of Nature, to that in a single omnipotent and omnipresent deity. In brief, it progresses from animism or preanimism, through animism to ancestor and hero-worship, thence to polytheism and a pantheon such as that of Olympus, in which one god may be the ruler, to dualism, such as Zoroastrianism with its principles of good and evil, and to monotheism with or without fallen angels and a devil.

In the sense of this ascending scale we might speak of "higher" and "lower" forms of religion. This involves, however, the assumption, which may or may not be justifiable, that monotheism does really represent the highest form of belief of which man has as yet shown himself capable. This would be in accord with western philosophy, which seeks to formulate a single principle or influence as basic in the universe—the Absolute—to be worshipped as a Supreme Being or reduced by science to a single physical force like that which binds the atoms of all substances together.

Whether we look to perfection as having been passed long ago, or regard it as the promise of the future, the fact that the spirit of man is ever striving to attain it is of particular significance. There is no reason for loss of hope when discontent leads to the endeavour to work for higher things. No progress is possible without aspiration; and self-satisfaction, therefore, signifies stagnation.

Unlike the creatures of the field, man can make his own environment and so promote the development and survival of any type which satisfies his ideals—poet, philosopher, film-star, or pugilist. His standards of value depend upon the use of his intelligence in fostering the inner light and continually fighting against forces of evil which tend to degrade him. He may not know the reason for his existence, but he does know that there are causes and effects

in the natural world on which he lives, and that he is subject to them. Whether he believes that this world and the whole universe were brought into being by a Supreme Power or not, he has to know the decrees of Nature in order to survive. Belief in a spiritual force may urge him to high endeavour, but upon him is the responsibility of working out his own salvation.

If the divine purpose of the existence and evolution of life is that man should work out his own destiny upon the Earth, it is difficult to understand what the ultimate gain will be when the Earth will no longer be in a condition to maintain life as we conceive it. All that science can say as to the future of the Earth or any other planet or system in the astronomical universe is expressed in the words: "Our little systems have their day: they have their day and cease to be".

We may contemplate the progressive development of man and society to whatever stage may satisfy our ideals, but, so far as we now know, the whole material phantasmagoria will eventually be dissolved, including the highest type of mankind conceived by the human mind.

This thought should not, however, be subversive of effort and aspiration on the part of humanity as a whole, any more than the individual should neglect noble motive and conduct because he himself has to pass away, whether his influence has been for good or evil. Though science is unable to provide any positive evidence for survival of personality after death, it must acknowledge that belief in such survival can be an effective factor in human development. It is just as permissible, therefore, to assume that another world awaits habitation by an exalted spirit of humanity after this Earth has come to an end as it is to believe in the eternal survival of personality.

Whatever convictions may be held as to the future of man or humanity, the standard of goodness is decided by the community. It is better to learn to do right because this is a duty to ourselves and to others than to make fear of punishment the code of conduct. The man who lives a moral life merely because he wishes to save his own soul is not taking a high standard of spiritual action; for his motive is personal profit. He may believe he will be saved from punishment hereafter by being negative to evil, but his life will be of no benefit to the human race unless he is positively good.

What existence awaits us when we cross the dark river we cannot say, but stimulus and high endeavour may be found in the hope that each thread of life can assist to form an harmonious pattern, even if the design is not known. Though science may not be able to contribute much to the ultimate problems of spiritual beliefs,

it does teach that every action carries with it a consequence—not in another world but in this—to be felt either by ourselves or others in our own time or in the generations to come.

This is the law of the natural world and it cannot be transgressed without punishment, whether by saint or sinner. It is learnt by direct experience in childhood, or from the experience of others, in effects which tread closely upon the heels of action. The laws of health can no more be broken with impunity than other physical laws, and there are penalties for every breach of them. In the court of Nature ignorance is never accepted to extenuate or forgive a fault; inexorable is the judgment and inevitable the sentence, which has often to be suffered not only by the offenders but also by their offspring for several generations.

As medical science advances, the relationships between these living causes and consequences are continually being disclosed for the benefit of the human race. Disease is no longer regarded as an "act of God", for which penitence and prayer are remedies, but as an evil to be overcome through the understanding of the natural agencies which have to be controlled and conquered, in order that the human race may survive and grow in wisdom as well as in status.

The laws or rules which members of a human community are expected to obey are man-made and not created forces like those of the natural world. As codes of conduct they are enacted for the common good, and actions detrimental to this end are offences against society whether they are punishable as crimes or not. All great religions and ethical systems include certain basic principles of social morality in their teaching. In these precepts, religion has been associated with high moral endeavour throughout the history of civilization. The professed sacred faith of a country, and the secular authority exercised through it, afford no true measure of the moral and social conditions of the mass of the people. This is as true of Christianity, with five hundred million people nominally attached to it by circumstances of birth, as it is of Buddhism, which is the nominal faith of about the same number.

The spirit of human brotherhood will never be established through the agency of a single religion, but with this ideal as the driving force of them all. It is the essential factor of all international equations and will determine whether the human race will make its kingdom on Earth worthy of exaltation to the spiritual kingdom of Heaven. Both science and religion can co-operate in this humanistic service, each in its own field and in its own way, yet united in their endeavours to attain high ideals by works as well as by faith. These are the influences which have affected the course of

civilization and the progress of the human race whatever relative values are attached to them.

Humanism, in the sense in which it is now best understood, is the integration of all human influences which promote the development of the human race, whether it includes the teaching of a particular religion or not. Whatever principles or practices raise man out of his animal ancestry and add to his status among living creatures can rightly be termed humanistic. Their spirit is manifested in works of science as well as in art and literature, and the measure of their value is that of improving human welfare on the highest standards that the mind can conceive. When these standards are supremely represented by attributes attached to a deity or deities, they are the elements of a religion of humanity, and devotion to them is the expression of an endeavour to cultivate goodness in thought and action.

Whatever views are held as to the meaning and purpose of man's existence, he finds himself on a globe from which he has to obtain material needs of life, and also with a mind which can appreciate such abstract qualities as beauty and love, justice and truth, whether seen on the Earth or projected on the heavens. Ethical or philosophic humanism takes account of all these factors of cultural development, secular or sacred. It understands very clearly that the Earth is but a temporary home not only for the short space of individual life but also for the whole human race. As tenants or trustees our duty is to make the best use of the resources of our heritage by the exercise of all our talents and with the belief and hope that by so doing we are helping to make men sublime, morally and spiritually, as well as godly in the sense of religious faith. So may the Earth become part of the heavens of the universe in spirit, as it is already in truth.

APPENDIX

AGES OF THE EARTH AND MAN

The Planet Earth	3,000	million	years.
Organic Life	1,200	„	„
Primitive Man	one	„	„
Modern Man (*Homo sapiens*)	30,000		„

CIVILIZATIONS, 4000 B.C.—A.D. 1900

THE FAR EAST.	China and Japan.
	Hinduism of Further India and Indonesia.
THE MIDDLE EAST.	India. The Indus Valley civilization, the Aryans, Hinduism and Buddhism, the Moghuls.
	Persia. Pre-Avestian and Avestian. Darius and Xerxes, The Seleucids.
	Mesopotamia, Sumeria, Babylonia (2), Assyria, Asia Minor and Western Asia.
	Mitanni and Hittites. Lydia and Cilicia.
	Syria and the Phoenicians. Carthage.
	The Hebrews and the Hebrew Kingdom.
	Islam. Baghdad, Egypt and North Africa, Spain.
	The Mongols.
	The Turks.
EASTERN MEDITERRANEAN.	Egypt. Old Kingdom, Middle Kingdom, New Empire, Ptolemaic.
	Crete and the Mainland. Minoan and Mycenaean, Helladic and Iron Age.
	Athens and Sparta. Alexander, Hellenistic and Alexandrine.
	Rome. Republic and Empire.
EUROPEAN.	(?) Neolithic and Bronze Ages.
	Iron Age—The Celts.
	The Roman Empire breaking up into : (a) Byzantium and the Slav peoples. (b) Roman Christendom, which coalesced in the centre and north with the invading tribes, the Germanic and Scandinavian cultures. This civilization, if

it can be called such, came to an end with the crowning of Charlemagne and foundation of the Holy Roman Empire (A.D. 801), the subsequent uprising of nationalities, and the fall of Constantinople (A.D. 1453), when modern European civilization begins.

AMERICA. Maya, Aztec, and, in the south, pre-Inca and Inca.

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