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A TEXTBOOK OF GYMNASTICS

VOLUME I

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VOLUME I

FORM-GIVING EXERCISES

BY

K. A. KNUDSEN

Late Chief Inspector of Physical Education to the Danish Board of Education

TRANSLATED BY

F. BRAAE HANSEN

Inspector of Physical Education, South Jutland; State Training College, Haderslev, Denmark; Late College of Hygiene, Dunfermline and Chelsea College of Physical Education (Men)

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Preface to the Second Edition

THE first edition, published in 1937, in one volume contained Form-giving Exercises only. In accordance with wishes expressed by British teachers of Physical Education, this second edition is issued in two volumes. Volume I contains essentially the same material (Form-giving Exercises) as did the first edition, with a few alterations and additions to bring the matter up to date.

Volume II will contain Heaving and Balance Exercises, Jumping, Vaulting, Marching, Running and other Agility Exercises, and will thus make the work complete. It is hoped that Volume II will be available shortly.

K. A. KNUDSEN.

ODENSE, DENMARK, 1947.

Preface to the First Edition

THE demands which the ideal teacher of physical exercises has to fulfil are considerable.

He (or she) should have a natural aptitude for *teaching*. He must be able to teach so that the pupils follow his lead and become interested in their work. He must inspire confidence, respect and devotion. In him they must see their guide, their leader and their friend.

He must master the *practice* of his subject. The exercises which he demands of his pupils, he must know thoroughly himself by *personal* experience. He must have proved their ability to strengthen and form the body and to give it physical culture. That physical culture which he wants to instil in his pupils, he must possess himself and he must preserve it through advancing years. He must be an example to them, not only as regards his subject, but also as a man.

He must have a thorough knowledge of the *theory* of his subject. He must be able to judge the marked and many-sided effects of physical exercises on the body, particularly the growing body, select what is beneficial and avoid what is harmful or merely useless. In other words he must understand the healthy body as the physician understands the ailing body. They should be equal in knowledge, each in his sphere. The domain of the one is just as important as that of the other. At present the physician is ahead of the teacher, he is about a hundred years ahead. But the teacher must catch up with him. And although it will take a long time yet, the first step has been taken. To the training of teachers of physical exercises now belongs as an invariable item some training in Anatomy, Physiology, Biology, and Hygiene in relation to physical exercises so that a better knowledge and a more rational use of them may be ensured.

Furthermore, the ideal teacher of physical exercises must have, particularly for the sake of gymnastics, *an artist's eye* for bodily beauty in positions and movements. He is like a sculptor of the living body. Plastic beauty of bodily form is a sure sign of a well-developed body, and light, elastic and controlled movements express bodily culture. The striving for physical beauty and the striving for physical health proceed along converging lines which finally meet at one point—the perfect body.

Gymnastics, and particularly form-giving gymnastics, constitute that branch of physical exercises which, as regards the teacher, is most exacting. As the name, form-giving gymnastics, implies, its special object is to form and develop the body harmoniously, more particularly the trunk, or still more definitely expressed, the spine, its joints and the muscles which move it, *i.e.*, the erector spinæ and the abdominal muscles.

Form-giving gymnastics is found in the Ling system only. Ling's greatest achievement is his invention of the form-giving exercises. He was in possession of the necessary qualifications for doing it. He had anatomical insight and he had an artist's sense of beauty and harmony. His form-giving exercises show his abilities as an artist, as a sculptor not in marble but in flesh and blood. They also bear witness to his insight in anatomy which he appropriately calls "the sacred Genesis which reveals to the eyes of man the masterpiece of the Creator." These exercises are classical and have come to stay. It was not without good reason that the Swedish Society of Physicians showed him the rare honour of electing him, not a physician himself, as a member.

It is the form-giving gymnastics that is dealt with in this book. The exercises belonging to it are simple and to all appearances easy to perform. They lack the inspiration of competition, which is an essential and healthy motive in most other forms of physical exercises and which makes the teaching of them easier. It is the understanding of their worth which must be an inducement to keenness in the use of them. Where this understanding is lacking they will never take their proper place. Who would be able to teach, hour after hour, such simple exercises as head pressing backward, trunk bending backward, stretch position, etc., if he did not understand what they mean and what can be done by them ?

The chief aim of this book is to describe, explain and give reasons for the form-giving exercises, to arouse and strengthen the teacher's interest in them and to widen their knowledge as regards these exercises.

Modern civilised life has deformed the human body. The animals have kept their harmonious build; man has not. Only few realise the full truth of this statement. Civilised man is affected with bodily deformities, beginning deformities in the children, deeply-rooted deformities in the adults. Form-giving gymnastics must therefore guide the development of the normal body so that faults and deformities are avoided. But that is not all. It must also be able to correct faults and do away with deformities as far as possible. In other words, it must be corrective, or, stated more clearly, orthopædic. It must treat the faults and deformities which have not yet reached such a degree that they fall within the sphere of the orthopædically trained doctors. Form-giving gymnastics, consequently, demands of the teacher that he is an orthopædist as regards the initial physical deformities. Here is a field where the work of the medical man and the gymnastic teacher meet. And here must be sought the main reason why they should be equals as regards knowledge so that they may discuss all border-line cases on an equal footing. This book attempts to contribute towards an orthopædics for beginning bodily deformities.

As most of the faults are to be found in the back, the book has before the form-giving exercises a chapter on the back, and it is hoped that it may contribute to the gymnastic teacher's understanding and proper treatment of this central part of the body, and it is furthermore hoped that the teachers, each one within his circle, will help to spread amongst parents the knowledge of certain fundamental rules for the development and care of the back. For it is often during the first months of a child's life that the deformity of the back is initiated.

According to the Publishers' advice the scope of the book has been limited. Consequently the chapters about Heaving exercises, Balance exercises, Marching and Running, Jumping, Vaulting, and Agility exercises belonging to the special part, are not included. If a demand should arise for a supplement dealing with these exercises from the Ling points of view, it might be within the range of possibility to have such a supplement written.

K. A. KNUDSEN.

ODENSE, DENMARK, 1937.

The Author

KNUD ANTHON KNUDSEN was born in 1864, the son of a farmer in the Danish island of Fyn. He was educated at Odense Cathedral School from where he went to the University of Copenhagen to study theology. After having graduated he took up teaching and specialised in gymnastics, in which he had been keenly interested since his early boyhood. He considered Ling's Swedish gymnastics, becoming known in Denmark during the early eighties, as being better than the old Danish system based on Gutsmuth's German exercises, and in order to be better acquainted with the system he went to Stockholm as a student at the Gymnastic Central Institute, the home of Swedish gymnastics. After having taken his gymnastic degree in medical as well as educational gymnastics, he returned to Denmark, and when the Danish Government decided to introduce Ling's system into the Danish schools and therefore opened a civilian gymnastic institute in Copenhagen in the year 1898, he was made principal of this institute and six years later also chief gymnastic inspector for all elementary and secondary schools, as well as for the training colleges. During his inspectorship he did a great deal to improve the training of the would-be teachers, and it was due to his efforts that physical education was gradually put into the hands of the ordinary teacher and not as hitherto in many schools into the hands of specialists, mostly ex-army men. He retired in 1934 at the age of 70.

He has written a number of much used textbooks and handbooks of gymnastics. Since 1932 he has made thorough investigations as to the prevalence of spinal deformities. These investigations have been carried through by him not only in Denmark but in most European countries, and he has found that in average 50 per cent of men and boys suffer from easily detected deformities of the back, whereas the average is substantially smaller in women and girls and the deformities less pronounced. He has written and lectured extensively on this subject and his methods as well as his results have created notice, and have often been referred to by medical men and educationists.

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II. SPECIAL PART

TEXTBOOK OF GYMNASTICS

I. GENERAL PART

§ 1. The Aim of Physical Education

It is the object of the school to give the child a general education and to further an all-round and harmonious development of its faculties.

This aim can only be realised if the education covers both the mental and the physical side of the child's nature.

It is a commonly acknowledged law that *mind and body are dependent on one another* ; this law is in force during the whole of man's life, but especially during the first years, and that in such a way that the growth of his mental faculties during this time is much more dependent on the condition of his body than vice versa.

During these first years the child grows more rapidly than ever afterwards. This steady growth demands that a brisk stream of blood be sent round to all the tissues of the body so that they may obtain the materials from which to grow, and the only means of promoting the speed of the blood is movement. Therefore Nature has given every healthy child an almost unconquerable desire for movement. A healthy child is really never quiet except when eating and sleeping. The more it is allowed to satisfy this desire for movement the more normal will be its development; the more it is hindered the more its health will suffer; many proofs of the latter fact can be found in large towns.

Movement, however, does not only further development of the body, but also development of the mental faculties. The child in the cradle realises itself and its surroundings by using its arms and legs. The mental development of a child before going to school is not all due to its observation of its parents' words and actions, but quite as much due to its own play—that is, its physical movements. The child cannot think and reflect about what it sees and hears—that belongs to a later age—but it tries at once to turn everything into action, and thus to train itself through what adults call play, which is often valued far too little. Play is for the child what work is for the adult. The child is just as much engrossed, just as eager—one might almost say as earnest—over its play as the adult over his work. Through this work of play the child gains experience, and through this are formed most of the ideas and conceptions which it acquires through this period of its life, and which express its mental development.

When schooldays begin, the time comes when mental qualities also, such as energy and the sense of duty, must be developed in the child; its former unlimited freedom is restricted; it is gradually led into mental work; it has to sit in physical inactivity for several hours every day, and gradually gets duties which have to be attended to outside the school. But as a counterbalance to the sedentary work at lessons, the school gives the child a certain amount of movement during school hours.

As the school does not devote many hours a week to the child's body, it is important to use the time to the best advantage. For this reason, and also because the child is no longer alone, but has to work together with many other children, *the school must systematise the work* and choose forms of physical employment where many can be kept at work at the same time. This brings us to the means for physical education now common in the school: handicrafts, gymnastics, organised games, ball games, swimming, etc. In this book only gymnastics is dealt with.

These forms of physical exercise do not, however, develop the children physically only, but they develop them mentally too, and this must not be overlooked.

That influence which can be exercised by certain study subjects such as history, on, for instance, the child's courage, will, and power of action might be termed theoretical. By describing the great figures in history one may rouse in the children the desire to show a firm will, great courage and strong power of action, but the ability to be courageous, strong-willed and powerful in action is not gained thus. Sociology may give the children a sense of loyalty and public spirit, and teach them to realise the importance of setting personal wishes aside for the common good, but it gives no practical training in these virtues. Theory must here, as elsewhere, be accompanied by practice, and the school must therefore try to combine two aims: to give the children ideals and to train them to realise those ideals.

In the gymnastic lesson the children learn exact and instant obedience. Besides this, they have an opportunity of showing courage, they are given tasks which claim all their will and energy, and they gain the physical ability which is necessary if the desire for courage is to be expressed in action.

During ball games or organised games the children learn to subordinate themselves for the sake of the common good; they learn obedience to laws, and their sense of justice is sharpened; never are young people more strict and just in their judgments than in a case of breaking the rules of a game or sport, or in any way not playing fair. In addition, they learn quick decision and independence, and the feeling of comradeship is increased.

There is, therefore, no doubt that a good physical education, conducted by teachers who have sufficient mental maturity to realise that it means more than mere bodily development, can contribute substantially to the child's mental development.

By gymnastics in the real sense of the word we understand movements chosen and formed with the object of giving the body an all-round and harmonious development. This freedom to give the movements a certain distinct form distinguishes gymnastics from all other forms of exercise. Those movements, for instance, which we perform during daily work, such as digging, reaping, planing, etc., or movements made during sports, such as kicking or hitting a ball, rowing, fencing, etc., all have a distinct external aim; both the movements themselves and the different positions of the body during the movements must depend on the work which has to be done. In gymnastics, on the contrary, when a man stretches up his arms bends his body forward or backward, and so on, he is quite free to perform these movements in that particular way and with that particular form which can best further the harmonious development of his body. All forms of movement, work sports, gymnastics, etc., have one great point in common—they give the body exercise and so strengthen it, provided the movements are taken under good hygienic conditions and do not cause overstrain. But gymnastics has, in addition, the great advantage of having a special power to mould and form the body by directing its growth and correcting any faults in carriage which may have arisen.

The most important physical aims of gymnastics will now be dealt with more in detail.

In the first place, gymnastics gives *suppleness*.

The movements of daily work are not as large as muscles and joints allow, and when movements never go quite to the limit, the ability to reach the limit is lost, or, more correctly speaking, the two limits of movement are brought nearer together as the lengths of the muscles have altered ; the mobility of the joints is now restricted, or, in other words, the joints have become stiffer. The reason for this is that the muscles and ligaments, like all organs in the body, adapt themselves to the use that is made of them ; when the muscles only make small contractions the fleshy part of the muscle grows smaller and they thus lose the power of making large contractions. Together with the muscles the ligaments have altered.

When a working movement seems large it is generally because many joints take part in it, but in the single joint the movement is small, or, at any rate, smaller than it could be. There is, for instance, no working movement which causes the arms to be stretched fully up, straightened fully out, and brought back as far as possible ; none which requires that the back should be bent as far backward, forward, or to the side as possible ; and none which causes the joints of the legs to be moved to their full extent.

There are examples enough of the fact that work diminishes suppleness. If a working-man never stretches his fingers fully out they will in the end become bent and stiff from the constant grip round his tools. If he never stretches his arms or legs strongly they will come to retain something of the half-bent position, which they have as a rule during his work. His shoulders, which were formerly in a good position, well back with the chest arched in front, are so often pulled forward by working movements that they remain forward if he does not frequently and strongly pull them back, and he becomes as flat over the chest as he was formerly over the back. His back, once straight and supple, will be stiff and rounded if he does not take care to counteract his stoop by stretching and bending in other directions.

The movements of gymnastics afford a strong contrast to working movements in this respect. It is, in fact, one of the most important laws in gymnastics that *in a great number of the exercises the movement must be carried to the limit of the joints.* In this way the working muscles are contracted as much as possible while the antagonistic muscles, together with the ligaments on the one side of the joint, are stretched to their fullest extent. If a muscle has become too short it can regain its normal length by movements which stretch it time after time; in the same way ligaments which have become too short may again be lengthened.

The question then is whether suppleness is of any importance. The answer must be that it is of great importance, provided we do not consider the exaggerated and unnatural suppleness of the acrobat, but the normal suppleness which we aim at in educational physical exercise. A man who has allowed his hands and fingers to grow stiff takes an awkward and clumsy grip on most work; one who has allowed his legs to grow stiff walks heavily and uses an unnecessary amount of energy in walking; while one who has allowed his back to become stiff and rounded has a less roomy and less flexible thorax, and is thus less able to breathe strongly and deeply. On the whole, suppleness is one of the marks of youthfulness, bodily beauty and health, just as stiffness is one of the signs of old age and weakness.

It is more common than is generally believed that children of 6 or 7 years, or even younger (Fig. 8, p. 86), have begun to be stiff, particularly in the back. In gymnastic teaching, therefore, we must, even with the youngest children in the school, use exercises which give suppleness.

If the normal suppleness is lost, we try to regain it by using temporarily fairly one-sided exercises that make for suppleness; for stiffness is a considerable hindrance to the harmonious development at which gymnastics aims, and to the pleasure felt by the pupils when performing the exercises in correct style. The joints of chief importance in this connection are only few, namely, the joints of the spine, the muscular connection between shoulder-blade and trunk, and the hip-joints. The three upper sections of the spine—the neck, the thoracic spine and the lumbar spine—are all fairly flexible towards their concave side, but comparatively stiff towards their convexity. The neck and lumbar spine must therefore be treated with exercises that bend them forward and stretch their strong, but often too short, muscles and ligaments behind, and similarly the thoracic spine must be treated with exercises that tend to diminish the curve. The stiffness of the hip joints as regards bending is counteracted by the same exercises that straighten the lumbar curve.

Besides this, gymnastics is *all-round* in its effect. Daily work, on the other hand, has on the whole a one-sided effect, for it claims continual repetition of the same movements and keeps the body in the same positions for a length of time. A man who is digging, for instance, repeats the same movements from the time he begins until he stops his work ; the same is the case with one who is planing, sawing, rowing, etc. Because of this, work has a one-sided influence on the body. The result is often an inharmonious development of the body which makes itself known by bad carriage (round or crooked back, shoulders pulled forward, hanging head, etc.), but which may also have an ill effect on the internal organs, such as the lungs, heart, digestive organs, etc. Even if a man is fortunate enough to be in such a position as, for example, a farmer, and thus have a different kind of work each day, he must not even then consider his work sufficiently all-round, because the working object, as it might be called, is always *in front* of the worker, and thus, whatever kind of physical work is being done, the working position is in the main the same. Also the mental worker bends his back during his work when he sits stooping over his books and papers. The most important distinguishing marks of the position alluded to are the hanging head, rounded back, flattened chest (and thus diminished chest cavity), bent arms, fingers and knees. It will be seen that it is in the bent positions that most work is done.

As has been said before, gymnastics is also in this respect the opposite of working movements. In gymnastics there is no continual repetition of the same exercise throughout the lesson ; when a movement has been performed a suitable number of times another is taken, and thus by degrees each muscle group in the body is used for a short time, but strongly. This is one of the conditions necessary for an all-round and harmonious development.

In one respect it may be said that gymnastics is one-sided—namely, in the use of stretched positions—but this is for good reasons. Daily work has so one-sided an influence on the body, with its many bent positions, that gymnastics must, in order to form an active counterbalance, go to the opposite extreme and use many exercises to stretch the body strongly and fully straighten out the joints. There are a great number of such exercises to be found in gymnastics—*e.g.*, the erect position, the stretch position, head bending backward, trunk bending backward, arch hanging, front lying, span bending, and many others.

One would think that a few hours of gymnastics could not have a noticeable effect against the influence which daily work is exercising from morning till night, day after day, with its monotonous and one-sided movements. But experience shows that good and well-conducted gymnastics can have a surprising effect, even on a body already affected by work. Though the gymnastic positions are held for so short a time and repeated so few times they can get the upper hand and give the body once more its original good carriage. This seems to point to the fact that good carriage is natural to the body, and therefore that gymnastics is the stronger because it works *with* Nature, while that which causes bad carriage works *against* Nature.

Besides this, gymnastics develops *general agility*. Agility means the ability in each given case to innervate right muscles to the right degree, with the right amount of speed, and at the right moment. This ability is gained by training in the sending of correct nerve impulses to the muscles. In this way we learn to use our strength economically; muscles which have nothing to do with the required movement are not allowed to take part and work against the others. Agility also means full control over the body under all conditions; many of the disasters, great and small, which happen in daily life are due to clumsiness. The external physical education which is shown by a free and fine bearing is in no small degree due to general command over the body.

Any work of a physical nature gives a certain amount of agility. The blacksmith, the joiner, the labourer, etc., have all gained great skill or agility in the use of their tools. The same is the case with the athlete, who performs with great agility the movements necessary for ball games, rowing, spear- and discus-throwing, etc. But it is a limited, a specialised agility which these men acquire; in other respects they may be awkward and clumsy. Gymnastics, on the other hand, aims at giving a more general agility; there are a great number of exercises—the so-called co-ordination exercises—of which each gives training in sending the correct nerve impulses, so that the muscles are brought to work together properly under various conditions.

It is also worth noticing that gymnastics is better able to *increase strength* than, for instance, ordinary physical work can. Even the young working-man becomes stronger by doing gymnastics. This may be due partly to the fact that a strong use of the muscles lasting for a short time increases the supply of nourishment more than their less vigorous use for a longer period.

Lastly, it must be mentioned that late investigations show that by proper training the body learns to make a better use of the various materials in the blood, which again means less strain on the heart and respiratory organs.

It was their striving for *beauty* which brought the Greeks so far in physical education of the youth that they still remain a glowing example in this respect. It is without doubt the loss of this appreciation of the beauty of the living body which is to a great extent to blame for the fact that human beings nowadays have forgotten what they owe to the body during its growth. It is therefore an important task to rouse once more the appreciation of the beauty of the body, and striving for this is an indispensable part of our work for a good and healthy physical development of our youth. If we take beauty as a guide, that, more than anything else, will be able to prevent gymnastics from leaving the right path and straying on to byways—such a byway as, for instance, in earlier times was trodden when the training in certain feats of skill and strength was considered the most important point. In such a case the great majority of people are excluded from benefiting from gymnastics, and for the few who have good aptitude the benefit can be but small, because health does not necessarily result from skill, and feats of strength often use more strength than they promote.

Man does not develop, mentally and physically, at an even rate from year to year, but according to a certain rhythm, quicker at certain periods, slower at others.[1]

The human body has three periods of growth :—

The first 6 years form the first period with a particularly rapid increase in height, greatest during the first year.

[1] The following considerations are taken partly from a pamphlet issued by a German Reichstag Committee for the Advancement of Physical Exercises, and partly from "The Rhythm of Development and Physical Education," by the Swiss scientist, Professor Eugen Matthias.

The second period, from about 6 to about 12 years of age, is a kind of intermediate period with fairly slow growth.

The third period is adolescence, which for girls lasts from about 12 to about 17, for boys from about 13 to about 18 years of age. Normally during that period a particularly rapid increase in height takes place first, after that we find a marked increase in weight (and in width). The most rapid increase in height for girls falls between the ages of 12 and 16, for boys between 13 and 18. The increase in weight (and in width) for both sexes begins about a year after the beginning of the growth in height and lasts about a year longer before falling to a slower level.

It deserves the notice of all educationists, and amongst them particularly the physical training teachers, that the marked growth of the girls begins a year sooner and lasts a year shorter than that of the boys, and consequently takes a more stormy course.

A certain amount of the materials taken in by the body from food and air is used in keeping up the body temperature and in sustaining the activities of nerves, heart, lungs, glands etc., all of which may be termed the *internal* work of the organism. By using the remaining part of these materials the organism may work outwardly, perform some *external* work, physical or mental. The more material demanded by the internal work the less will be left over for external work, and vice versa.

During the periods of rapid growth not only must the vital activities be kept going, but also material for growth must be provided. Consequently, the internal work of the organism is much greater and the amount of potential external work correspondingly far smaller during these periods than when growth has finished.

These periods may be called *periods of leniency.* The young people should be exempted from such work and exertions which retard the growth of the body by consuming the materials necessary for the internal building work of the organism. But while it is wrong to give the young people too hard work to do, it is equally wrong to give them too little work. The periods of rapid growth are also *sensitive* periods, *i.e.*, periods in which susceptibility of influence is particularly great. The impulse necessary for normal growth during these periods can only be given by movement, because a nourishing blood stream to the growing tissues can only be stimulated by movement. *The time of greatest growth is therefore the time of greatest demand for movement.*

Consequently, it cannot be too strongly emphasised that during adolescence one must guard equally against too little, as well as too great, physical exertion.

Several investigations have been made as to the influence by school life on the development of the children, and they have shown that the sedentary life in the school retards the growth of the children.

By weighing children between the ages of 6 and 7 it has been found that the children who entered school at the age of 6 during the year increased less in weight than those who first began schooling at the age of 7 ; in the case of the boys the average difference was 0 .7 kg., for the girls 1 .3 kg.

By examining 1,000 school children, Quirsfeld found that 16 per cent of the boys and 26 per cent of the girls lost weight during the first school year ; of the rest 30 per cent of the boys and 44 per cent of the girls remained stationary.

In a girls' high school where the pupils were 16 years of age, the age when they ought to increase most rapidly in weight, it turned out that, although they increased their weight by an average of 2 .8 kg. during the summer vacation, during the following terms they lost in weight increasingly as the holidays receded, altogether 1 .2 kg., so that their full increase in weight for the whole year, the long vacation included, only came to 1 .6 kg.

These investigations show how important it is to counteract the retarding influence of school life by physical exercises adapted to age and sex, and the demand for physical exercise is hardly fulfilled by less than an hour's exercise daily. They also show that the girls are in greater need of exercise than the boys.

Bodily exercises are necessary, not only for the sake of the individual, but also for the sake of society, and the race.

The neglect of physical training, so common amongst the civilised peoples of our time, has resulted in the European race increasing in height but not correspondingly in width, in chest girth. The tall, narrow-shouldered and narrow-chested type is a product of the civilisation of our day, particularly amongst the higher classes and amongst the studying youth.

This type of body denotes a decline. The right relationship between height and chest girth is of fundamental importance for the health and vitality of the race. The structure and mobility of the chest are of great importance to the capacity of the lungs. There is a definite relationship between chest girth, height and tuberculosis. Examinations of soldiers and life-insured people have shown that the ratio between chest girth and height conforms less to the normal with tuberculous than with non-tuberculous people.

A German scientist, Friedenthal, says that all over Europe one may see that in families that have improved their social position the originally normal proportions of body and limbs are altered during the next generation; the limbs are now longer, the trunk is shorter, and the head smaller; furthermore, the period of growth in height is lengthened to the detriment of the growth in width. Together with these changes, nervous irritability grows and sterility increases.

Facts such as these show the range of the problem—physical education. Not only the individual but the race is concerned.

§ 2. Exercises and their Classification

It is, as was emphasised on pp. 6, 7, one of the main objects of gymnastics to give the body an *all-round* development.

It follows from this that there must be exercises for practically all joints and groups of muscles. It is not sufficient to have one or even several exercises for each part of the body; there must be a certain selection. partly for the sake of change and partly for the sake of all-round development.

In addition, there must be easier exercises for beginners and more difficult ones for the more advanced; there must be exercises to suit smaller children and some to suit older ones. Also the exercises must not be quite the same for both sexes; though this is not so important with smaller children as with older ones it is especially important during the age of puberty and with adults.

There must be simple uncombined exercises which mainly aim at developing and forming each single part of the body and bringing it into its right position in relation to the other parts—*e.g.*, exercises for the arms, shoulders, neck, back, etc.; but besides these there must also be combined exercises, which mainly aim at developing agility, as stated on p. 7; these are called co-ordination exercises. The most important are balance exercises, vaults, and agility exercises.

In order to develop muscular strength exercises are needed in which the muscles work actively, and thus receive a suitable training. This work ought to be proportionate to the size of the muscles. Big muscles must have harder work to do, *i.e.*, must be used for more powerful exercises, than smaller ones. The easier the exercise is to the muscles working the more often it has to be repeated to further development. A professional violinist will develop a strong right arm by using the bow but only because the movement, which requires but a slight exertion, is repeated innumerable times. A gymnast who has only a short time at his disposal must use comparatively strenuous exercises.

To correct acquired bodily defects or deformities it is necessary to have exercises sometimes involving active muscular work and sometimes affecting the muscles passively. If a muscle has become too long, such a muscle has to work actively, especially in a shortened condition, in order that it may become shorter. If, on the other hand, it is too short, passive extension is necessary to lengthen it. In a round back, *e.g.*, the dorsal extensors of the thoracic region are too long. To correct this defect active work by these muscles is imperative.

Lengthening of a too short muscle must, on the other hand. be done by a force outside the muscle itself. Such force may be represented by the antagonists of the muscle or muscles in question. The work of the antagonists, however, is not always enough or might require too long a time to be effective. Shortened pectorals, *e.g.*, cannot within a reasonable time be lengthened by active work of the muscles which bring the arms into stretch or yard position. Other forces must be resorted to, such as inertia, gravity, muscles other than the antagonists or the aid of a gymnastic partner.

Inertia is without comparison the means which is most often and most effectively employed when shortened muscles (and ligaments) have to be made longer or joints have to be made more mobile, which comes to the same thing. Inertia is made use of in large movements such as arm circling; arm swinging upward; arm flinging; span hanging, leg swinging; overgrip hanging, arm travelling with leg swinging sideways, etc.; but it is also made use of in small rhythmical pulling movements in positions where the limit of movement has been reached and where one endeavours to increase the mobility of the joint or joints in question by small but energetic pulling movements or jerks (examples are: rhythmical pulling in twist standing, side arch standing, and stoop standing positions).

Gravity plays a part in exercises, such as stretch hanging and span hanging positions, etc. Here the weight of the body, which is at rest, extends the muscles that are too short.

The influence of muscles other than the antagonists manifests itself in exercises such as heel raising in the span bend position, because here the tension is increased by the heel raising performed by the calf muscles; or in trunk bending downward grasping the ankles or a low bar, as here the flexors of the arms pull the trunk further down towards the legs than the mere weight of the body could do, and consequently stretch the lumbar extensors and the hamstrings.

An extension of muscles (and ligaments) performed by the aid of a partner is employed particularly in remedial gymnastics, but may also be used in ordinary gymnastics. Its use should, however, generally be limited to adult beginners.

As will be seen from the many demands made on gymnastics, a great number of exercises must be at our disposal in order that the object of gymnastics may be attained, and these exercises have been arranged in *groups* according to their *effects*.

It is clear that the classification of exercises according to their effects is the only correct and natural one, as it is the only one that makes it possible for the teacher to be clear as to which movements to choose in making a table in which the important rule of all-round work is observed. But there is one difficulty about this classification—as yet we do not know enough about the effects of the different movements, and this is especially the case with regard to their physiological effects (*i.e.*, effect on respiration, circulation, digestion, etc.). We have, therefore, to be content with classifying the movements according to the chief muscle groups used, or according to other points which distinguish them especially.

Exercises within one group are again divided into *sub-groups*. The group Dorsal Exercises, for example, has the following sub-groups: Trunk leaning forward, trunk bending downward, front lying, and lunging forward. Sometimes one of these sub-groups is again divided; for instance, lunging forward is divided into standing, toe support standing, and fix standing lunging forward. Game-like exercises or special forms of exercises for small children are given as a special division of each group. In each group the different exercises are arranged according to difficulty, so that the easiest are put first and the most difficult last.

The exercises do not all fall easily into place in the different groups. The more simple an exercise is the easier it is to classify; the more complex it is the more difficult to classify. For an arm stretching, a knee bending, a trunk bending backward, a front lying, and such exercises, it is easy to find the right place because their field of action is so small and limited. But a movement brought about by more than one great set of muscles will often fall between two groups of exercises. Stretch hanging knee raising is, for instance, chiefly an exercise for the abdominal muscles, but it is in addition a heaving exercise. Lunging forward is both a dorsal and a leg exercise.

The points common to all exercises within a group, together with any special points, will be given as an introduction to the detailed treatment of each group of exercises.

The exercises may be divided into three main divisions:—

A. *Order exercises*, used in arranging the pupils and putting them into position for their different exercises.

B. *Form-giving exercises*, the main object of which is to mould the body into a harmonious development of its different parts by eradicating faults and producing suppleness.

They are mass exercises, and they are divided into the following groups:—

Leg exercises
Arm exercises
Neck exercises
Trunk exercises

C. *Exercises of skill*. They further neuro-muscular co-ordination, and most of them have a stimulating effect on the organs of respiration and circulation. They develop bodily strength and endurance, and several of them may further qualities such as courage, energy, and presence of mind.

Generally they are individual exercises that encourage competition and make the pupils keen and happy in their work. They are divided into the following groups :—

Balance exercises
Heaving exercises
Marching and running
Jumping and vaulting
Agility exercises

The erect position and the position of ease are considered as standing outside the groups and will be treated separately.

§ 3. The Table

(*a*) *Rules for the Construction of the Table.* By the table is understood a series of exercises which are chosen and arranged according to certain rules for a gymnastic lesson.

The two main rules according to which the exercises are chosen and arranged are the following :—

1. Exercises must be chosen for the different parts of the body, so that the whole body is exercised.

2. The exercises must be arranged in such a way that there is an even increase in effort until toward the end of the lesson, and then an even decrease. Consequently, easier exercises must be chosen for the beginning and the end of the lesson, more strenuous and difficult ones for the middle part. Thus the work in a well-arranged gymnastic table can be shown graphically as a curve which rises more slowly than it descends.

The first main rule, the rule of "all-roundness" in the work, must be adhered to, partly because gymnastics must counteract the effect of the one-sided movements and positions of daily life, and partly because single parts of the body are often used so strongly in gymnastics that they could not continue the work for very long at a time. By working first at one part of the body and then at another we gain the advantage of being able to give the pupils a greater amount of useful movement without danger of strain ; it is the case here, as everywhere else, that there is a kind of rest in change of work.

This rule of being all-round is not, however, fully carried out by choosing movements from all the different groups. Firstly, the movements chosen must harmonise with each other in strength, form and co-ordination. Easy exercises should not be chosen from one group and difficult ones from another.

Secondly, they must be arranged according to their secondary effects. Exercises within one group may be widely different as regards their secondary effects, whereas exercises from different groups may have secondary effects that are much alike.

Thus a trunk bending backward, a front hand lying, and a hanging high knee raising are all abdominal exercises, but their secondary effects on the lumbar spine differ greatly. The first exercise bends the lumbar spine forward, the third bends it backward, while the second does neither the one nor the other. In the same way the secondary effects of some of the exercises belonging to the dorsal group are different. The three exercises: front lying, trunk bending downward, and trunk leaning forward affect the spine very differently. A trunk twisting, a trunk bending sideways, a trunk leaning sideways, and a side hand lying are all lateral exercises, but in the first the spine is twisted round its long axis, in the second it is bent to the side, and in the last two its position is practically the same as in the erect position. A high jump, a jump to balance hanging position, and a heave jump are all jumps, but there is a great difference in their secondary effects on, for instance, the arms. In a high jump the arms are scarcely used, whereas their extensor muscles are used very strongly in a jump to balance hanging and their flexor muscles in a heave jump.

As an example of the other case, that exercises from different groups may have the same secondary effect, we may mention a deep span bending, a low arch hanging, a front lying trunk bending backward, and a standing trunk bending backward. These are all exercises belonging to different groups, but they have in common a marked bending of the lumbar spine. The various exercises chosen for the table must therefore harmonise in such a way that in their secondary effects they counteract one another.

In other cases similar secondary effects may not be actually harmful, but they may involve a continued use of certain muscle groups which are therefore disproportionately tired. If, for instance, the stretch position were used for several exercises in succession the arms and shoulders would be tired, and the result would be that some of the exercises would be badly performed, since in the end the muscles could not be exerted as they should be. If we took for a balance exercise wing run standing knee bending with trunk leaning forward, for a lateral exercise a lunging sideways, for a dorsal exercise a lunging forward, the extensors of the knee would have one-sided and tiring work.

In order to prevent the above-mentioned mistakes in the construction of a table, the teacher must not only consider which muscle groups the exercise, according to its classification, makes use of, but also be clear as to the movements caused in the joints and the resulting positions of the various parts of the skeleton in relation to each other.

The second main rule, the rule of an even increase and decrease, is well known from practical life when a work of great effort has to be performed. The racehorse is not allowed to run directly it leaves the stable, but it is given a little gentle exercise first; when the race is over it is not immediately taken back to the stable, but is ridden for a little while. It is chiefly on account of the heart that a work of great effort must be prepared for by an even and gradual rise and concluded by an even fall. In an adult human being the heart beats from 60 to 70 times a minute during rest; during strong work the number of beats is often increased to more than double. At the same time the amount of blood driven out with each beat is increased, so that the actual amount of blood passing through the heart during one minute may be six times as great under strong physical work as during rest. For this increase a dilation of the vessels, particularly the capillaries, is required, and this dilation takes time. It will thus be understood that a too sudden change from rest to vigorous work may cause overstrain and permanent injury to, or weakening of, the heart.

The work of the respiratory organs is also considerably increased during great physical endeavour. The normal breathing in an adult at rest is 10 to 12 breaths a minute; during effort this can be increased to double or more; at the same time the volume of air changed with each breath is increased. The respiratory muscles can bear this great increase of work better if the increase comes gradually.

In the same way even increase in the exercises of all the muscles and the joints in the body makes it more possible for them to stand the strong work which every gymnastic lesson should contain. Besides this, it is a fact that the muscles work less surely and strongly when cold, while at the same time the joints are less movable; by the preparation before the principal exercises the circulation is quickened and the production of heat by the body is increased. Thus the muscles are prepared for working more strongly, quickly and surely, and the joints are made more supple.

It is not, however, sufficient to follow these two main rules. There are *other things* to take into consideration in the working out of a table. Care must be taken, for instance, that there is the proper amount of change between free standing work and apparatus work, between slow and quick exercises, between mass exercises and individual exercises. In this way one-sidedness in the work is prevented, and life and speed come into the lesson. On the other hand, we must not in our effort to do this go too far and rush the pupils from one piece of apparatus to another; this would be tiring and would take away that smoothness which is necessary in gymnastics. The exercises must be chosen in such a way that they follow easily and naturally after one another, and that the small breathing spaces which are so refreshing to the pupils come in the right place and are utilised for putting the apparatus in order and arranging the pupils at the apparatus, etc.

Besides the exercises which are written down in the table, some calming and soothing exercises (*depleting*) must be taken after work involving much exertion. Such exercises help to make the circulation easier and to equalise the distribution of the blood which has been sent to strongly working organs; in this way they help to remove the results of the momentary effort and make it possible to go on more quickly to a new exercise without danger of overworking the pupils. It is of importance that the teacher should know the strength of his pupils and follow their work during the lesson, so that he has a feeling of how much he is requiring of them and can judge when he must put in a depleting exercise or when give them a rest.

Dead points with long pauses in the work must be avoided in the construction of the table. This is not difficult if the gymnasium is large and well supplied with apparatus and the number of the pupils is not too great; but if the gymnasium is small, with little apparatus, and the pupils, on the other hand, are many, the table must be adapted to those special conditions, and team work must be used to a very great extent (see p. 55).

If the teacher is one day taking an exercise which takes a long time to be introduced and set going, he may that day pass over other exercises in order to get the necessary time. In the same way one may occasionally break off when part of the table has been taken and use the rest of the lesson for games or sports. But these greater or smaller deviations from the normal table must be exceptions, for it is of such importance that a gymnastic lesson should be all-round work for the body that one must not alter the normal table without reason.

(*b*) *The Normal Table.* The order of the exercises in the table has undergone many changes since the rhythmical work has been introduced and the transition from one exercise to the next is done without stopping. It is now possible to put more work into the time available for the lesson than formerly. And this is of great advantage.

For older children and adults the following plan of a table may be called the normal one :—

A. A series of free standing exercises capable of forming the body and producing flexibility and comprising :—

Leg exercises,
Arm exercises,
Neck exercises,
Trunk exercises (lateral, abdominal and dorsal ex.).

B. Mass exercises on apparatus developing form and strength, producing agility and stimulating the bodily functions. These are :—

Span bendings with complementary exercises,
Powerful trunk exercises (lateral, abdominal and dorsal) at wall bars, on stools and benches, etc.,
Balance exercises,
Heaving exercises,
Marching and running,
Jumping, vaulting and agility exercises (and games).

C. Final exercises consisting of :—

Leg exercises,
Trunk exercises,
Breathing exercises, or
Marching.

The exercises in Part A give the whole body that easy work mentioned on p. 17, which is to prepare it for the strong exertion of the exercises in Part B. As these exercises are easily mastered by the pupils they may be taken in quick succession, and through these the teacher can, from the very beginning of the lesson, introduce that life, keenness, order and discipline which is to characterise the whole lesson. The speed must, however, not be so great that the exercises are performed in a slovenly manner, in incorrect form, and without going to the full limit of the movements. The ability of these exercises to prepare the body for greater exertion, to quicken the circulation in practically all tissues, to give that warmth which makes difficult movements surer, depends in particular on whether the movements of the exercises are carried to the limits so that the muscles contract fully and are extended to their full limit. The consequent alternate relaxing and extension of other tissues will further the circulation in them and make them elastic. The exercises in Part A should, as a rule, not take up more than about 15 minutes of a lesson lasting in all 40-50 minutes.

As the first of the exercises in Part B we take *span bending.* This is not a particularly strenuous exercise, especially when care is taken that the breathing is not restricted more than necessary. It is first and foremost an exercise for carriage, and as such it gives such a strong stretching and such an effectual straightening to the curve in the thoracic part of the spine that it becomes easier to do the following exercises with good carriage. As a span bending has, as mentioned before, the secondary effect of hollowing the loin, an exercise to bend the lumbar curve strongly in the opposite direction must be taken as a complementary exercise—*e.g.*, trunk bending downward in its various forms. Another complementary exercise, fully as good, which should be much used is hanging, high knee raising.

After span bending some *trunk exercises* (lateral, abdominal and dorsal) are taken at apparatus such as wall bars, stools, benches, beams, where they may be made more vigorous and more varied than the free standing trunk exercises in Part A. Exercises for the thoracic spine with its backward curve should not be forgotten. This part of the back requires at least as many and as powerful exercises as the lumbar spine with its forward curve. Exercises with the face moved downward towards the legs or the legs moved towards the face, and thus affecting the small of the back, are numerous (standing, sitting, ying trunk bending forward ; lying or hanging high knee and leg raising, etc.). But there are not so many exercises, and especially not so many powerful and easily available exercises for the stretching of the thoracic spine. And this part of the spine, more than the lumbar spine, needs a straightening of its curve, which is usually too large. It is stiffer, and consequently harder to influence than the loin. It also needs a developing of its muscles—those from the middle of the thoracic spine to the back of the head, the principal muscles of carriage—so that they may have the normal strength, length and tone. These muscles are strong, and powerful exercises are necessary for their developing. When they have their proper length and strength they give the upper part of the trunk, the bust, as the sculptors say, its plastic and harmonious shape by carrying the head high, straightening the spine and arching the chest. They also give the right carriage of the shoulders by moving backwards the lower cervical vertebræ from which the shoulders are suspended. The well-shaped bust influences the parts of the trunk below. It will give the lumbar spine its correct form owing to the labour-saving balance which the spine on its own tries to bring about. The most powerful exercises for the thoracic and cervical regions of the spine are neck support hanging; neck support fall sitting, stretching of the hips; "log raising"; neck pull; stretching of the arms as after sleep, etc.

After these exercises we have a series of *agility exercises and exercises stimulating the bodily functions.* By these the co-ordination necessary for each individual exercise is developed. The final result will therefore be a many-sided training in co-ordination, producing what we might call an all-round co-ordination. This would enable one to respond to all the unexpected demands of ordinary daily life as regards co-ordination and nimbleness, and it is most valuable as it often enables one to avoid accidents.

These exercises may demand strong work from a greater or a smaller number of muscles, which naturally results in a corresponding development of these muscles. They also stimulate the bodily functions, such as breathing and circulation.

First, we have *balance exercises.* They are in a marked degree exercises of co-ordination, a kind of agility exercises. In order to maintain equilibrium the perfect working together of a great number of muscles is necessary. A difficult balance exercise should not come immediately after vigorous and fatiguing exercises, as fatigue has a detrimental effect on co-ordination. Not only physical but also mental exertion (such as hard study before an examination) makes balance exercises more difficult. The way in which one masters balance exercises is a pretty good indication of the degree of nervous fatigue. Several balance exercises on apparatus take up a long time for each individual pupil. Such exercises are best taken in squads, together with jumping and vaulting, and there should not be more than 4 or 5 pupils in the squad, as otherwise time is wasted. A squad of 8 or 10 for jumping may be divided into two for these balance exercises.

After balance exercises *heaving exercises* follow. Heaving exercises are only in a small degree exercises of agility and co-ordination. Those performed with *straight arms*, the so-called hanging exercises, produce flexibility by stretching the pectoral muscles, the latissimus dorsi and the abdominal muscles. Heaving exercises performed with *bent arms* are particularly good in producing muscular strength. By strengthening the muscles of the shoulder-blades and shortening some of them to their normal length several of these exercises help to give the body its natural form, but this is only the case when they are performed correctly. Done incorrectly, they may deform the body in no small degree by pulling the shoulders forward, as they then shorten the pectoral muscles and lengthen those that keep the shoulders back.

After heaving exercises come *marching* and *running*, where the work is done by the legs instead of the arms. Most marchings are easy exercises, which, like other easy leg exercises, can have a depleting effect and give a good breathing space between strenuous exercises. Running can sometimes be taken with particular stress laid on the introduction of good form in the run and sometimes as endurance running. Amongst the exercises stimulating the bodily functions, long-distance running, endurance running, is the most typical one, owing to the strong effect it has on the organs of respiration and circulation. Running must always be followed by an easy marching.

The whole body has now been strongly worked through. It has been warmed, the joints have a feeling of suppleness, the muscles act quickly and surely. The pupils are therefore well prepared for the most difficult and strenuous part of the table : *jumping, vaulting* and *agility exercises.*

Whereas balance exercises as a rule are easy exercises of co-ordination, jumping, vaulting and agility exercises are mostly strenuous exercises of co-ordination. During a strenuous output of energy the muscles must be controlled by the nerves, so as to work together with the greatest precision and with a minutely exact adjustment of the strength needed at a particular moment. Consequently, nervous fatigue makes it at least as difficult for one to perform strenuous exercises of co-ordination as muscular fatigue.

In regard to jumping, an introductory jump should, as a rule, be taken, such as standing jump upward; jump forward with one step run, etc. It is also, in many cases, best to take a jump which can be taken by many together—*e.g.*, high jump over low beams, over forms, stools, etc.; upspring to balance hanging, heave jump in ropes or beams, provided that there is a sufficient amount of apparatus, etc.

Those jumps, vaults and agility exercises which are individual exercises must, as mentioned on pp. 55 and following, be taken as team work.

In the choice between the various jumps, vaults and agility exercises, there must be, as elsewhere, a suitable variety, so that those taken in one table do not resemble each other too much, for vaults are by no means leg exercises alone; besides the leg muscles, it is sometimes those of the arms or those of the back, front or sides which are especially active.

For men, jumping, vaulting and agility exercises should, if the pupils are not beginners, take about 20 minutes of each 45-minute lesson; for women this would, in general, be too long and have a straining effect.

As the last part of the table come the *final exercises*. The physical activities, such as respiration and circulation, can with comparative ease be calmed down after exertion for the pupils to stand the change to rest and sedentary work without risk. The final part of the table may therefore be made much shorter than the introductory part.

The exercises chosen for the final part of the table must be *slow* exercises, which let the muscles employed work to their fullest extent from extreme contraction to full extension. Such exercises especially help the circulation and equalise the distribution of the blood; they have something of the same effect as massage for removing fatigue materials from the muscles, and in that way giving a feeling of well-being. During the final exercises special regard must be paid to respiration, and wherever possible the exercises should be taken in time with the breathing. The final exercises, like other mass exercises, do their part in producing good carriage, something which is often neglected during team work. Breathing exercises proper are in themselves corrective exercises.

The final exercises have not only a physiological but a pedagogical importance, and the latter is by no means less important than the former. During the jumping, vaulting, and agility exercises, the pupils usually have worked in squads, and therefore to a certain extent have been left to themselves. It would not then be in accordance with the order and discipline which must characterise all gymnastic teaching, and which should be one of its points, if the pupils, without more ado, hurried out of the room. On the contrary, it is from a pedagogical point of view a valuable conclusion to the lesson that the pupils first put in the proper place all the apparatus which they have used, and then assemble in line to take a few free standing exercises which not only once more enforce good erect carriage, but also claim full attention and quiet, and thus have a calming effect both physically and mentally. When, then, the pupils, after falling out, march out of the room, or in any other way leave it in good order, a well-worked-out gymnastic lesson has been brought to a fitting conclusion.

(c) *The Table for Children.* The table which has just been described, as was mentioned before, is suitable for adults, and in its main points for children from 10 years of age.

But for children of the age of 6 *to* 8 *years* it must undergo a good deal of alteration. We must remember that children, before the age of going to school, supply themselves with the necessary amount of physical movement by throwing themselves into games; in other words, movements which do not localise the action to single muscle groups or joints, but which take practically the whole body into use. The transition to true gymnastics must take place gradually; the movements taken must put all, or at any rate many, of the children to work at the same time; they must give a great deal of exercise; and, especially at first, they must be a natural continuation of the child's own free movements; they must be easy to grasp, so that long explanations are avoided (see p. 58). Children of this age cannot get any benefit from gymnastic exercises which have great definition and form, among other things, because their ability to isolate the working parts of the body from other parts which should be kept comparatively quiet and at rest (see pp. 35 and following) is not developed. Just as little can they gain any benefit from combined exercises (co-ordination exercises), because their nervous system is not trained to allow the muscles to act together with sufficient exactness.

For children of this age the gymnastic lesson therefore must be used for games which give strong movement—running games, pulling games, and games where they have to use their imagination; among the various games must be inserted exercises which train the sense of time, and exercises which claim *attention*, both of which must be taken in such a way that they retain something of the character of a game. The last-mentioned group does not consist of special exercises, but ordinary exercises which claim attention by the way in which they have to be performed—*e.g.*, standing, arm swinging sideways, sometimes with and sometimes without a hard beat against the legs; turnings taken quickly after one another, etc. Besides these there must be used exercises which have an enlivening effect, called *enlivening* exercises, consisting of specially quick and strong movements, or movements following quickly one after the other—*e.g.*, Down on the back! Up again! Quickly from open order to hang from the top wall bar and back again, etc. There must also be exercises which accustom the children to instant *obedience*—*e.g.*, to stop a game immediately at a signal or word of command. *Heaving exercises* with straight arms (*hanging exercises*) on fairly low apparatus must also be practised early and frequently in order to teach the children to hold fast, and to stretch muscles which may have become too short. When we can begin the *form-giving* exercises (and these must be taken comparatively early, see p. 5), they must be of such a nature that the children can get the correct form of the exercises without difficulty, because they are not easy to perform wrongly—*e.g.*, prone lying on the floor; back lying, leg raising; hanging, knee raising; arm travelling with straight arms, etc. (see p. 38). Finally, we must begin the first forms of agility exercises, which must have some of the character of games and must not be too difficult. We ought to begin, also, to teach the children the recognised movements of civility (bowing, curtsying, etc.), and so accustom them to politeness and free them from awkwardness in this respect; the lesson should always end with a falling out.

Thus for children of 6 *to* 8 *years of age*—a fixed scheme for a table cannot be given, although the exercises must not be chosen without any plan. The rule of beginning with easier exercises and taking the strenuous ones in the middle part of the table must still be adhered to. In the same way games, and especially the game-like exercises, must be chosen in such a way that one-sidedness is avoided and the body gets all-round work.

For children of 8 *to* 10 *years of age*, games must still take up a great part of the table, though not as much as with the younger children. The games must, especially for boys, contain to a greater degree elements of competition and contest; running games which claim a more prolonged run are also suitable. For girls especially, fairly easy dancing games may with advantage be inserted among the other games. The gymnastic exercises must gradually take a more distinct form, although many of them must still retain something of the character of games. Most heaving exercises should still at this age be taken with straight arms, and we must still use exercises of attention and enlivening exercises, and others which more and more accustom the children to discipline.

From 10 *to* 12 *years old* the children are at the age where it is most advantageous to teach them gymnastics; they are old enough to be able to learn all the easier exercises of true gymnastics; they like to work, and they have not yet come to the difficulties of the age of puberty. The normal plan for a table in its main points can be used, though some games must still be taken. The teacher should be careful not to take too difficult span bendings, while stress must be laid on the jumping, vaulting, and agility exercises—of course, always within the bounds of the children's abilities. Real ball games can also be introduced at this age.

In the special part of the book, under each group of exercises, there will first be dealt with the various sub-groups of ordinary exercises, and then, usually as a special sub-group, the game-like exercises, or special forms of exercises for small children. Passing from game-like exercises to the true exercises, as well as passing from one exercise to another within the groups for the different ages, must take place gradually in the school work.

The Age of Puberty. In the 12th to the 13th year for girls and the 13th to the 14th year for boys the children enter upon the so-called age of puberty. During this age such great mental and physical changes take place that special regard must be paid to it in the gymnastic teaching, though more with girls than with boys.

The age of puberty is the child's last growing period. In the course of 2 to 3 or 4 years a great increase takes place, both in the height and weight of the body. The children increase on an average in a year 6 cm. in height and ·5 kg. in weight. The increase in weight is not only due to the fact that the bones and muscles become bigger and heavier, but also to a considerable storing-up of fat in the loose connective tissue which ties the skin to the underlying muscles and bones (subcutaneous fat layer); it is this fat layer which gives the soft, rounded forms, and in that way the specially plump and fresh appearance which we find in this age. As this increase in weight takes place more quickly than the muscles increase in strength, the muscle power is relatively less than before.

The power of co-ordination is also diminished in the age of puberty. This is especially due to an alteration in the mechanical conditions under which the muscles are working. The growth of the bones in length and thickness gives a change in leverage, so much the more as this growth in the different bones takes place periodically, and not at the same time. In this way, for instance, the humerus and femur grow quickly, while the growth of the forearm and leg is very small. The result is that a nerve impulse of the same strength as formerly does not now give the same amount of movement, and that therefore a new training of co-ordination must take place. This is seen in the lack of ability to master their movements which characterises children of this age. The more suddenly the growth takes place—some can grow in 8 to 10 months quite as much as others grow in 2 to 3 years—the more awkward, clumsy and inco-ordinate are the movements. The fatigue often caused by quick growth diminishes to a still greater extent the power of co-ordination (see p. 88).

These changes in physique during the age of puberty are common to boys and girls. With girls, however, other changes have to be taken into consideration.

Whereas a girl's body has until the 12th or 13th year the "male" shape, with narrow pelvis and broader shoulders, during the age of puberty the pelvis grows so much that in the adult woman it is nearly as broad as the shoulders. Besides this, with girls, in contrast to boys, the connection between the bones of the pelvis at the symphysis pubis and between the sacrum and hip bones remains comparatively loose and yielding, a condition which plays a considerable part in parturition, and which, therefore, must not be adversely affected by overstrong physical exercise.

When the pelvis thus increases in breadth while its joints do not correspondingly grow more secure, a mechanical deterioration has taken place. The broader pelvis gives a broader and weaker abdominal wall. To balance this the muscles which go from the pelvis up to the thorax (the abdominal muscles and those parts of the erector spinæ lying farthest out to the side) get somewhat better leverage, which, together with the fact that the upper part of the body is now proportionately lighter, makes such exercises as trunk bending sideways, trunk twisting, trunk bending, and trunk leaning backward comparatively easy.

With regard to the legs, the broader pelvis of the woman causes the femurs to stand more obliquely inward, which from a mechanical point of view makes the legs weaker.

Besides skeletal changes, alterations also take place for both sexes in the conditions of the circulatory organs, which is shown by less staying-power and greater tendency to palpitation of the heart and breathlessness.

The reason for this is that the strongly increasing growth claims strong work from the circulatory organs, while the growth of these organs does not even correspond to that of the rest of the body. In childhood the weight of the heart is greater in proportion to the weight of the body than in the adult, and therefore is also comparatively stronger, which is one of the reasons why children show such endurance in games. The diameter of the arteries seems also to be comparatively smaller in the age of puberty than earlier, which must also increase the work of the heart.

Lastly, there may come in this age, both with girls and boys, but especially with the former, great irritability and lack of mental balance, which must be taken into consideration in all teaching, and not least in the teaching of gymnastics.

All this considered, it is clear that during the age of puberty all overstrain must be avoided, but certainly not exertion. During that period the body needs that incentive to growth which only movement is able to give. Growth may be equally retarded by too much and too little movement. The point is to find the right measure, the correct amount, of exercise.

It must be a main rule for both sexes that the table should contain many and easy exercises rather than few and difficult ones. Those exercises, especially, which may have a hampering effect on the respiration, and thus also on the circulation, must not be too strenuous. Such exercises are those which employ muscles attached to the thorax; consequently, especially lateral, abdominal and heaving exercises. This, however, does not mean that these exercises should not be used, for the muscles of the trunk, arms and shoulders, of course, must have their proper amount of development in this age, with all the other muscles; but they must be given sufficient work by means of easy exercises, preferably those which do not cause the pupils to *remain* long in the positions. It is in this age even more important than at other times (see p. 36) that respiration should be continued during the exercises, and that the air in the room be kept fresh and free from dust. Those heaving exercises can be recommended in which part of the weight of the body is carried by the legs or is in some other way supported (fall hanging, high arch hanging, twisting in the window or square ladder). For span bendings, those should be chosen where the span-bending position is only kept for a very short time (fall angle hanging, span bending; heave toe standing, span bending with a step forward). Marching and running (though not endurance running or vigorous runnings, such as a longer race or playing football on a large field) are very suitable for the age of puberty; they give considerable exercise, and the principle of giving many and easy exercises is fulfilled, as the single running steps give no strain worth mentioning to the strong leg muscles, and in addition cause no fixing of the thorax and consequent hampering of the breathing. The same applies to dancing movements, which in the same way consist of many small movements, each in itself being easy enough, but together giving strong movement. Strong jumping, vaulting, and agility exercises, on the other hand, must not be given to pupils in the age of puberty.

The lessening of co-ordinative power causes a decline in the pupil's skill in gymnastics, both in the special co-ordinative movements and as regards the co-ordination which gives precision in the exercises in general.

As it is in the age of puberty, which is the last real time of development, that the body especially gets its form, form-giving exercises are of great importance here. Therefore great stress must be laid on the choice of such exercises as, without being too strenuous, can correct faults in carriage, and also on the correct performance of the exercises ; this can be claimed so much the more in the case of form-giving exercises, as these put no strain on the co-ordinative power, being rather slow and uncomplicated ; with girls this is especially the case, as they, because of the broader pelvis, can do many of these exercises comparatively easily.

The special conditions present in the girl's physique, especially the large, loosely connected pelvis and the more oblique femurs, make it necessary to be specially careful with them when taking jumpings and vaultings, especially such of these as lead to a deep landing. Some other jumps and vaults ought, for æsthetic reasons, not to be taken with girls in this age any more than with adult women.

Heaving exercises also should for girls be still easier than for boys, because of the weaker shoulders and heavier pelvis of the girls. The agility exercises should also be easier ; of this whole group there are only a few exercises which can be used. Balance exercises, on the other hand, are very suitable for girls, but in introducing these exercises it must be remembered that they claim a large amount of co-ordinative power.

The quick, strong and often somewhat angular movements, which girls sometimes at an earlier age have in common with boys, now begin to give place to soft and more subdued movements, and therefore more stress must be laid on such exercises as can further the plastic, the soft, and the expressive.

For the time *after the age of puberty* there should be, with young men, especial stress laid on all that inclines to strength agility, and athletic power. For young women there may certainly also be an increase of difficulty in the exercises, but this must be much more in the direction of perfection of form and expression and grace than in the direction of strength and courage, while it must be remembered that the special conditions in the physique which began in the age of puberty are still present in the adult woman.

It must be emphasised that women, as a rule, should not do gymnastics during menstruation.

(*d*) *The Table for Shorter or Longer Lessons.* The construction of the table described above is suitable for a lesson of about 45 minutes with a class of big children or adults, corresponding in number to the gymnasium and its apparatus. But the framework of the table is so elastic that without breaking its principles the teacher can adapt it to both longer and shorter lessons.

The table can be arranged for a *longer* lesson by repeating the various exercises a greater number of times, and thus introducing and practising them more thoroughly by increasing the number of form-giving exercises as well as agility exercises and exercises stimulating the bodily functions. For male pupils who have sufficient endurance more time should be spent on vaulting, jumping, and agility exercises in particular. Female pupils might be given more trunk exercises, and balance exercises.

The table may be arranged for a *shorter* lesson by repeating the various exercises fewer times and by including fewer exercises, both of those that are form-giving and those that make for agility and stimulation of the bodily functions.

In deciding which exercises on each occasion should be left out, regard must, of course, be paid to the sex, age, standard of ability, etc., of the pupils.

(*e*) *Passing over to a New Table.* The teacher must not at once pass over to an entirely new table, for then in the first lessons after the change the pupils would get far too much explanation and too little movement. In addition, it is not wise to teach many new exercises in the same lesson.

Passing from one table to another must therefore take place gradually by a few exercises being changed and the table which is the result being worked at for some time. The exercises first to be changed are those which are easily learnt and less important, while those which are valuable and more difficult to learn are kept longest.

It is a fairly common assumption among less experienced teachers that the exercises must be changed frequently if the interest of the pupils is to be kept; but this is a mistake. It is when the exercises in a table have been carefully explained and understood, when the pupils are accustomed to the arrangement of the apparatus and to the order and run of the lesson that the conditions are present for the work to go with speed and energy and for the pupils to be given good practice. In this lies one of the best means of calling forth keenness and pleasure in the work from the pupils.

As mentioned on pp. 37—39, with regard to the degree of difficulty of the exercises, the progress must be neither too quick nor too slow in changing from one table to another.

The table is not a drag on lively teaching, nor a tie on the teacher's freedom to allow his particular characteristics to appear in his work. It is a help for him to keep order and method in his work, and to arrange it sensibly so that the pupils may get the best possible result. The table is one of the things which has lifted gymnastics to a place among the pedagogically arranged and regulated subjects.

§ 4. Form and Faults in the Exercises

The fact that in gymnastics the movements have no aim outside the development of the body gives gymnastics an advantage over other forms of physical exercises in that the gymnastic movements can be chosen and formed without considering anything but the furthering of the development of the body (see p. 3). The exercises have therefore been given that certain form which, according to present-day knowledge of their effects, is thought to be the most beneficial to the body.

From this standpoint it will be understood that *the form of the exercises is of the greatest importance to their effect*, and that it is one of the main points in the teaching of gymnastics to bring the pupils to perform the exercises as correctly as possible. The important thing now is that the teacher by means of his physiological and anatomical knowledge and his knowledge of the effects of the various exercises can distinguish between what is important and what unimportant, as this is one of the many cases where *the inconspicuous points are of more importance than those which first meet the eye.* Among the many examples of this may be mentioned trunk bending backward. If this movement is performed by a bending in the loin alone, the pupil can bend much farther back and appears to have done a strong and effective exercise. As a matter of fact, he would get far more benefit from the exercise if he took a smaller bending with as much of the movement as possible in the thoracic part of the spine. Another example is the stretch standing position, where, for one who does not understand, it seems fairly unimportant whether the arms are pressed an inch farther back or not.

While the teacher sees with comparative ease the importance of life, precision and time in the exercises, it is found to be a good deal more difficult for him in practice to understand the importance of the form, and it must therefore to a great degree be his duty to learn to know each single exercise, so that he understands what is first and foremost to be gained by it. In this way only will he gain the joy of thorough comprehension of his work, and escape the danger of its becoming a mechanical commanding, bearing the mark of the trivial.

With smaller children and untrained pupils it may temporarily be necessary to depart from the correct form of certain exercises, but this is only the case when such departures are unimportant (see p. 39).

Beauty as a Guide. As a knowledge of the effects of exercises is as yet incomplete, and as the teacher's training is often defective, especially as regards insight into anatomy and physiology, it would be good if another help could be given him to support him where his knowledge falls short. Such help can be rendered him by his sense of beauty.

In the first place, it can guide him to judge the measure of exertion suited to the pupils, for if a movement is to be performed according to the laws of beauty, it is necessary that the pupils can control it (see p. 39), and in that way all exercises which are beyond the pupils' strength are excluded, as they will always be done in incorrect form. This does not exclude the development of strength, for very energetic and therefore developing work is necessary in order to gain and maintain good carriage and harmony in the body.

In the second place, the demand for beauty leads to all-roundness in the work, and thus excludes one-sidedness and striving for special skill and strength in a single direction. One who cares only for vaulting will not get the upper part of his body developed. One who practises, for instance, to excel in heaving exercises alone, or in exercises on the parallel bars or on the horizontal bar, will have over-developed shoulders, while the lower part of his body will be disproportionately weak. Marked examples of this disproportion in development, sad to say, can be seen in international meetings, where stress is laid on specialities.

The importance of this sense of beauty in exercise makes it desirable that the teacher should gradually train in himself something of the same feeling for harmony and form in the movements and positions of the body as a sculptor has. He will also keep himself fresher in this way and more alive for his work, and at the same time make it more generally educative for his pupils.

There may, however, lie a danger in this striving for beauty, partly in that it can be overdone in the direction of the soft, the enervated, and the strengthless, and partly because, by leaving what is simple and natural, it can degenerate into artificiality and stiltedness. The best guard against this last danger is the teacher's general education.

Any deviation from correct form in the performance of an exercise is called a *fault*. The word "fault" embraces all deviations, beginning from the comparatively unimportant and extending through all degrees to deviations so great that the good effect aimed at does not appear, or even the opposite effect is the result, so that the exercise in that way becomes harmful and works against good carriage.

An exercise consists of *starting position*, *movement*, and *final position*. To avoid faults in the exercise the starting position first must be correct; this is gained, as emphasised on p. 37, by the exercise leading to it being first introduced. Next the "range of movement"—that is, the movement from the starting to the final position—must be properly understood and well introduced before the exercise can end with a correct final position.

Almost any exercise is an example of this. If the stretch position is incorrect, a trunk bending backward or sideways or a trunk leaning forward taken from that position has a fault in it from the beginning, and the movement must be wrong. It is not, however, certain that the range of movement will be correct even if the stretch position is quite correct. If the pupil has not understood how to perform the movement in these exercises, or has not yet the ability to be able to perform them, then his range of movement will be wrong and he will end in a wrong final position.

As the erect position is the original starting position for all exercises, it follows that the first thing to be aimed at is to get that position correct. There are, however, two sides to that position in that it is also an expression of good carriage, and in that way is one of the aims of gymnastics as a whole, and thus of each single exercise; in this way it becomes also a measure of advancement towards good carriage.

Besides the faults which pertain to each single exercise, of which the most important are given under the description of the exercises in the special part of the book, there are faults of a general character, which can assert themselves in practically all exercises.

Of this group comes first and foremost the *lack of ability to isolate those muscles* which are to work during an exercise from those which have nothing to do with the exercise (to localise muscular action). This lack is especially prominent in children and is connected with the fact that their nerves are not trained in commanding the various muscles with sufficient exactness Gradually as the children get practice in various movements this ability grows, and it is of great importance that its development is as all-round as possible. If this has not taken place it is seen that the adult also, outside the limit of those movements in which his work has trained him, has a sorely defective ability for muscle isolation.

Many examples can be given in this connection. The most typical, and in addition the most important, is the erect position. When a child of 7 or 8 years tries to take the erect position it contracts practically all the muscles of its body, and as a result often takes a very incorrect position. The head is held stiffly, the arms held as if there were no joints in them, and the muscles on the trunk are contracted so that the thorax becomes stiff and the breathing is restricted; in short, the whole living body has become a dead wooden figure. Something of the same, as a rule, is to be seen with adult beginners. The fault is that the muscles which stretch the knees, straighten the spine, keep the shoulders properly back, and the head lifted, are not trained to work independently of the other muscles.

Arm bending can be given as another example of this. This small but quick and energetic movement should only put the flexors of the forearm and some of the shoulder muscles to work. But as a rule with untrained pupils, both children and adults, all the upper part of the trunk is also seen to work during the performance of the exercise, as the head and abdomen are brought somewhat forward, thus increasing the curves in the spine. In this way serious faults are caused in an erect position which may have been irreproachable before the exercise.

A third example is trunk leaning forward. This exercise is so simple that beyond a slight movement in the ankles it consists of nothing but a movement in the hip-joints ; but every experienced gymnastic teacher knows how long it is before the pupils can learn to avoid a bending forward in the loin.

A fourth example may be found in jumping, vaulting, and agility exercises (co-ordination exercises). The difference between a beginner's high jump (which looks as if the whole body resisted the movement) and the high jump of the clever gymnast (where the whole exercise goes easily and without apparent effort), arises from the fact that with the former the various parts of the movement are hampered by the intrusion of muscles which should not be working. The same is the case in a head spring, hand spring, etc.

Yet another example is found in heaving exercises, where the pupils so often are seen to kick, bring their legs forward, or make faces. Such small movements (by-movements) make the exercise cramped, and one has the impression that it is an enormous strain.

Thus it is seen that the outcome of lack of power of isolation (localising muscular work) can be stiff and dead positions, or movements which cause serious faults in the exercise itself, or small movements (by-movements) which are really not serious faults in themselves, but which show that the movement is impeded and cramped.

One of the most unfortunate results of incomplete localising of muscular work is that *restriction of the breathing* during the exercises which is so common, not only with beginners, but also with well-trained gymnasts. The reason for this restraint is that during the exercises those muscles which fix the thorax are also put to work. With many exercises there is very little or no reason for this ; for instance, dorsal exercises, which, as a rule, put the thorax in just the position which is most favourable for respiration. With other exercises there is some reason for restricting the breathing, as the muscles from the thorax to the arms, shoulder-blades, or pelvis, are made to work vigorously ; this is especially the case with heaving exercises and lateral and abdominal exercises. But even during these exercises the breathing need not be nearly as much restricted as is generally the case.

In order to train correct muscle isolation the teacher must from the very beginning remind his pupils to stand freely and easily in the various positions, that is, to slacken the muscles whose help is not required in keeping the position and to perform the movements with full force without letting muscles which are not concerned join in. Before all, he must be untiring in watching that the pupils breathe as freely as possible while they are doing the exercises. In order to counteract cramped positions the teacher may make the pupils take small easy movements with those parts of the body which should be inactive. In that way, while the gymnasts are standing in a certain position there are often taken, on command or simply on information, small, quick movements with the head or arms (for instance, during the erect position, lean position, lunge position, etc.).

For the rest concerning the correction of faults, refer to p. 53, etc.

§ 5. Progression in Gymnastics

The ordinary pedagogical rule that *one must go from easier work to more difficult* holds good also with regard to gymnastics, but the rule has not yet been as well applied in gymnastics as in academic subjects. One gymnastic exercise in many cases forms the foundation for another to follow, as the final position of the one is the starting position for the one following; the first must therefore be introduced and to a certain extent learnt.

As an example of this may be given stretch stride standing, trunk leaning forward. Before this exercise is reached the pupils must have gone through the following exercises from the erect position :—

1. Arm bending and arm stretching upward.
2. Wing standing, trunk leaning forward.
3. Bend standing, trunk leaning forward.
4. Bend lean standing, arm stretching upward.
5. Foot placing sideways.

Each of these introductions, however, is an independent exercise, so that the pupils do not have the feeling that they work for a long time only at something which is a preparation for other exercises, for this would weaken their interests.

It must not be understood by this rule of gradual progression from easier to more difficult work that the pupils must be able to perform one exercise perfectly before they can begin on the next. If this were the case the teacher would have such a limited stock of exercises, especially in the beginning, that he could neither give his pupils all-round and strong exercises in each lesson, nor keep their attention aroused and their pleasure in gymnastics alive. Therefore he must know what is most important in the exercise (see p. 32), and for a time be content to correct those faults which especially concern this. Further, he must choose exercises which are easily learnt, because they do not claim as much form, but yet which give strong movement, together with exercises where the form is so unimportant that no harm is done by lesser irregularities in the performance of them. Thus, especially with smaller children, one must not keep a high jump until all the introductory jumps have been introduced, but rather let the pupils jump at once without troubling about the form for a time. Later, as the children's sense for movement is developed by the work, the separate parts of the jump are taken, for to postpone teaching the form is by no means the same as to forget it. To progress in this way is really to follow the main rule of "going from the easier to the more difficult," as by claiming less form the exercises are made easier.

On the other hand, one must not go forward too quickly. Young teachers have not gained by experience sufficient understanding of, and sufficiently sharp eyes for, the importance of form. They often forget that exercises which are easy for themselves are difficult for their pupils, and unthinkingly take for granted that the latter must have just as hard exercises as they themselves need, if the interest is to be kept up. The result is that they pass over to the harder exercises too quickly. Especially where co-ordination exercises are concerned, the teacher must remember that untrained gymnasts use considerably more strength in these exercises than trained ones. The untrained pupil has not learnt to regulate with sufficient exactness the nerve impulses to the working muscles, and the result is that the muscles join in the action with either too much or too little force, too early or too late. In addition, he often sends nerve impulses to muscles which should be entirely passive, and which may even come to work against the other muscles. In short, the harmony of the muscle work is disarranged, and thus *the work is increased* (see p. 36).

It must be added that the longer the pupil practises a co-ordination exercise which is beyond his strength and standard of development as a whole, the more likely he is to introduce into the co-ordination faults which can be corrected only with difficulty. It is one of the teacher's most important tasks to teach in such a way that he makes the pupils eager to reach as far as possible towards the correct form in every single exercise. A short explanation of the effect and the value of the exercise may be helpful.

Those exercises which are only of value if their correct form is maintained—*e.g.*, arm bending, trunk leaning forward, span bending, overgrip hanging, body raising—must never be lightly passed over. The teacher must therefore not begin to work with them before the pupils are a little older and have had practice in other exercises, and thus have come so far that the most harmful faults can be avoided, so that work with exercises of distinct form is really profitable. On the other hand, it will not do to wait so long at them that every detail is performed correctly; the point is, as mentioned before, to distinguish the important from the unimportant points. When such an exercise has been worked at for a suitable length of time, it should be left for a while and returned to later. In the meantime exercises of the same difficulty, or even easier ones, can be taken. When the pupils' ability and strength have increased by this work the teacher may return once more to the uncompleted exercise, and now claim more correctness, often by taking it in a more difficult form (another starting position for the arms, legs, etc.). By returning to the exercise in this way the pupils feel their progress; those difficulties which before were insuperable they can now succeed in overcoming, and this increases their keenness and interest.

If it is found that an exercise which has been correctly explained and illustrated is still performed in such a way that the majority of the pupils make serious mistakes in it—among others, of restricting the breathing too greatly—then the exercise lies beyond the pupils' standard of strength, and the teacher must choose another and less difficult exercise from the same group.

The next question is *how* this progression can be maintained when dealing with the various exercises of the same type (sub-groups and their divisions; see p. 13).

Exercises of the same type are made stronger by making the muscular action greater, by increasing difficulties in form, or by more numerous repetitions of the exercises. It often happens that an increase in muscle work at the same time increases the difficulty of form.

The muscular action is most often increased by making the weight arm of the lever longer. This takes place especially in trunk exercises — trunk bending backward, leaning forward, bending sideways, front lying, etc,—by letting the pupils move their arms higher up —*i.e.*, by in turn using the wing, bend, across bend (or fling), yard, reach, stretch positions. By taking other starting positions for the legs — *e.g.*, by using in turn standing, stride standing, walk standing (outward, then forward), outward lunge standing, forward lunge standing, half kneeling, and kneeling positions sometimes the muscle work is increased and sometimes the difficulty in form.

For the rest, the progress in each sub-group will be seen from the order in which the exercises are described (see pp. 13, 14.) As regards the transition from children's exercises to the exercises proper, refer to pp. 24 and following.

§ 6. The Teacher

To be able to teach gymnastics with ability, a teacher must possess certain qualifications.

Some of these qualifications are *general*, in as far as they are common to all teachers. A teacher must be able to deal with children, he must understand them and be fond of them, and he must be able to win their confidence. He must himself possess that culture which is necessary to have an educative effect on them and to help in developing their character, and he must be able to create order and discipline among them. There is especial reason to emphasise this last point, because the gymnastic teacher has the children under more free and, from a disciplinary point of view, more difficult conditions in the gymnasium or games field than in the classrooms. The student will find these general qualifications dealt with under the subject of Pedagogy.

In the next place, a number of *special* qualifications are necessary for a gymnastic teacher.

It is the body which he is to work with and develop. Therefore he must, to as great an extent as possible, know that body, its structure, its functions, and the laws for its development. He must therefore have insight into anatomy and physiology, and be able to apply this knowledge in his teaching.

In addition, he must have a thorough knowledge of the stock of exercises, so that he has a broad view of the whole and also knows the various exercises with regard to their form, their effect, and their application to various ages and standards of pupils. The details of these questions are dealt with in the description of the various exercises.

He must himself have tried the various exercises and gained the greatest possible skill in the performance of them. This has several advantages. First, he is convinced as to the effect of the exercises, and his belief in them and in what can be gained by them is confirmed. In addition, his theoretical knowledge of the exercises is fixed and extended through his experience in the gymnasium, and this gives him a surer and more practical grip in teaching them. Besides this, a good demonstration by the teacher (here it is the younger teachers who are especially meant) has a powerful effect in giving the pupils that keenness and understanding which a good example always promotes.

If physical exercises are to have their full share in the whole development and education of the child, they must be an incorporated part of the school work. For this it is necessary that the school, both management and teachers, should have understanding and knowledge of the subject. This can only be the case if it is the real teachers in the school who work at physical exercises and themselves teach it; as long as the school leaves this work to persons who have no connection with, or insight into, the rest of the school work, physical exercises will continue to stand outside.

The question, then, is whether the teachers who have charge of the gymnastics should not teach some other subjects also — in other words, whether we should have special teachers or form teachers for gymnastics. Where both systems have been tried experience has shown that the form teacher, as the one taking charge of the physical training, is to be preferred to the specialist, both in the elementary and the secondary schools.

With regard to the form teacher system, the advantages and disadvantages of which are dealt with more in detail in pedagogy, we will here only remark that during physical exercises other sides of the child's nature appear than during ordinary subjects, and therefore the teacher who has charge of the child, both in physical exercises and other subjects, gains a wider and more all-round knowledge of its nature. The teaching of physical exercises thus helps the teacher to understand the child, which is, of course, one of the first conditions necessary for real education.

Besides this, it is too monotonous for a teacher to take one subject only ; also for that reason the gymnastic teaching in a school should not be given by one but by several of the teachers.

Last, but not least, it is of great importance, for the sake of the position of the subject in the school, that there is not a difference in education between the gymnastic teacher and the other teachers. In this way the children, the parents, and the school management will gain more respect for the subject.

§ 7. Teaching

(*a*) *Plan in Teaching.* A good result can just as certainly be obtained in the school work for the physical development of the children as in that for their mental development. Whether or not this result is obtained depends first and foremost upon there being a thoroughly worked-out plan in the teaching.

Directions as to the making of a plan for a single lesson *i.e.*, the table for the day--are given on pp. 15 and following. It is most important that this table should be well thought out. The teacher must on no account be content to make it in the course of the lesson ; it must be thoroughly prepared and written out beforehand.

He should also, particularly during his first years as a teacher, refresh and perfect his knowledge of the exercises so that he may have all details regarding them ready at hand during the lesson ; he must, by judging the standard of his pupils, make it clear to himself which details in an exercise the stress should be laid on. All this is necessary in order to secure firmness and efficiency in the teaching and life and progress in the work.

Besides the plan for the day's work there must be a plan of work for the year. *The exercises must be arranged according to the different classes in the school.* Every teacher must work out his own plan for the year according to the needs of his pupils, the weekly hours available, the gymnasium and the apparatus at his disposal, and his own qualifications as a teacher.

The teacher, for instance, may form his first year's plan for a class by marking in the book those exercises which he considers suitable for that class, and for the conditions under which he has to work. When he leaves any exercise out of his table because he has finished teaching it—either entirely or only temporarily—he enters it on a form, which may be arranged as the one given on a small scale on this page.

This plan, then, shows the work which he has taken with the

SCHEME OF EXERCISES

ORDER EXERCISES	LEG EXERCISES	ARM EXERCISES	NECK EXERCISES
1 2 3 4 . . 15 16	1 2 3 4 . 15 16		
LATERAL EXERCISES	**ABDOMINAL EXERCISES**	**DORSAL EXERCISES**	**SPAN BENDINGS**
BALANCE EXERCISES	**HEAVING EXERCISES**	**MARCHING AND RUNNING**	**JUMPS**
HEAVE-JUMPS AND VAULTS	**AGILITY EXERCISES**	**GAMES**	**BREATHING EXERCISES**

children. This is naturally of great value to himself if he is to teach the same children in the next class, but it is of still greater value if a new teacher is to carry on his work.

The plan which the teacher has thus worked out in the course of the first year for a class of a certain age may be the year's plan for the next class of that age, with such alterations as possible changes (*e.g.*, more lessons, a better room, better apparatus, etc.) may necessitate.

It goes without saying that the teacher, in the course of the year, must take advantage of the experience which he gradually gains, and therefore alter and improve the plan with which he began the year.

When drawing up a plan, especially that for a single lesson, the teacher must choose his exercises in such a way as to bring *all* his pupils as far forward as their ability and aptitude for the work will allow. He must always remember that the aim of gymnastics is to give to *all* the best possible physical development, and not to bring a few of the best pupils to so high a standard that they are able to give a display. It is a great fault in a teacher to neglect the weak and awkward pupils for the sake of the capable ones ; those who are weak are the very ones who especially need help and encouragement. Naturally he must not give them too much attention at the expense of the strong and active pupils, but the danger of this is not so great.

(*b*) *Explanation and Illustration.* When introducing an exercise which is new to the pupils, the teacher must first *give an explanation.* This should, as a rule, be quite short, and at first only relate to the main points of the exercise. He must on no account deliver the theoretical explanation which was given to him during his course of training ; in the first place, this would take too much time ; and secondly, the pupils would not have the qualifications necessary for understanding and retaining such an explanation. After the explanation, or together with it, there must be an *illustration* of the exercise, given by the teacher himself or by a capable pupil ; in the latter case especially, the explanation and illustration may to some extent be given together. On the whole, *the main point is to let the pupils themselves perform the exercise as soon as possible.* When they have tried it they stand in quite a new relation to it, as they have felt the point of the exercise and where the chief difficulties lie. The teacher, too, can see how much they have understood of his explanation and illustration, and so be clear as to what points must next be especially emphasised. He should make a halt in the exercise and command the class to stand easy, while he explains to the pupils what main fault the majority of them have made. He should show them this fault, and, as a contrast, the exercise properly performed, thus gradually opening their eyes to the correct form of the movement. After this pause he should again command the exercise, in this way letting theory and practice alternate—in other words, combine them.

While this way of teaching a new movement is especially used with mass exercises, both free standing and those performed on apparatus, there are others, especially co-ordination exercises (jumping, vaulting, agility, and balance exercises, etc.), which are so complicated that it would be difficult to explain them in words. The best way of teaching such exercises is to give a good and neat illustration. If the teacher is no longer able to do this himself, he may choose a capable pupil to show the exercise. Then the teacher corrects each pupil individually and points out to him the mistake he makes.

When giving an explanation the teacher must speak slowly and distinctly. This makes it possible for him to use fewer words and to give his words more weight, so that they can be better understood, especially by the younger pupils.

When an exercise is to be explained or illustrated the class must always be commanded to stand easy. The erect position is one of effort, and therefore the pupils will be tempted to relax it of their own accord if the command to rest is not given.

For explanation and illustration the teacher must be careful to *choose such a position* that all the pupils can see him without difficulty, both to enable them to follow the teaching and also to prevent inattention. Often, if a more careful explanation or illustration is to be given, and the pupils are in open order, it will be found convenient, if the teacher has trained them, to run on a certain word of command (*e.g.*, "For illustration – ready !") and place themselves along the two long walls facing him. If he then stands in the middle of the gymnasium, each pupil can see without difficulty and follow what is shown and explained. On such a command as "Back to your places— run !" they run quickly back to their original positions. With many exercises the teacher may confine himself to letting some of the pupils sit during his illustration. If an exercise is to be shown at the wall bars, beam, or any such piece of apparatus, the pupils may stand round in a circle or semicircle.

The teacher must be careful that the pupils see the exercise from the side on which the main points are most distinctly brought out—from the side, front, or back, as the case may be.

When an exercise has been explained it must *immediately be performed* by the pupils. No other exercise or other explanation must be allowed to intervene. The teacher, therefore, with regard to the class arrangement, apparatus, etc., must have everything prepared, so that the pupils may at once begin the exercise.

The teacher must, on the one hand, avoid the danger which lies in a tendency to explain and theorise too much, but, on the other hand, he must remember that there is a danger in saying too little. In the latter case his attitude towards the work becomes less personal, and therefore his interest in it is not expressed in such a way that the pupils can grasp it. The pupils, too, will not understand, or at least will easily forget, which points they are especially to remember when they perform the exercise. The teacher, therefore, not only before the exercise, but also during the performance of it, must constantly remind the pupils by means of short, stimulating words of what they must aim at (the correct form, beauty, ease, time, life, energy, etc.).

(*c*) *Method of Work.* The teacher must introduce one thing at a time in such a way that, as stated on pp. 32, 33, he takes the most important first. This especially concerns all that there is to learn about the correct form, but it further concerns such points as simultaneousness, time, speed, quickness and quietness—*i.e.*, steadiness in a position or complete stillness after an exercise. It would be formless work to attempt to introduce all these things at once; both teacher and pupils would forget one point while thinking of the others. When, for instance, the pupils are going to learn standing, arm bending the teacher first teaches it to them slowly, so that they can find the right range of the movement and the right final position, the bend position. Not until after this should stress be laid upon speed and strength in the movement, on simultaneousness, localisation of muscular work, etc.

The mass exercises have to be conducted by the teacher in all details. On the other hand, the individual exercises performed in squads are merely started by a single command from the teacher when the squads are in their appointed places and the different pieces of apparatus put in order. The teacher's activity is then limited to a correction here and there, to stimulation and encouragement, in order to make the exercises go with life and spirit.

Mass exercises may be conducted in four different ways: (1) performed "*freely*"; (2) taken "*by numbers*"; (3) taken in "*individual time*" or "*individual rhythm*"; and finally (4) in "*joint-time*" or "*joint-rhythm.*"

Exercises performed "*freely.*" When the teacher has explained the exercise the pupils are set to work freely with it, each one independent of the others. During this practice they find out what is difficult and what is important, and they obtain an impression as to the effect and the value of the exercise. Used judiciously, this method is useful in teaching the pupils what to strive for in each exercise; in that way their understanding of the exercise and their interest in it will increase.

The method can by no means be applied to all exercises, but in several cases it may be used with advantage, even in the case of simple and formal exercises, such as the stretching of the upper part of the back from slack to erect position; the introduction of exercises, such as bend position with the hands, elbows, back and head held correctly; arm flinging, moving the hands within the correct range; easy and springy landings in connection with introductory jumps. It is also advantageous to use it when introducing complicated exercises with unaccustomed co-ordination and where the brain must control the movements till they become habitual and partly reflex actions (*e.g.*, exercises where arms and legs are used simultaneously). Certain mass exercises of balance are most easily learned when the pupils go through them freely a few times.

The free way of working is eminently suitable for adults, particularly students training for the gymnastic profession. Work of this kind will to them be a putting into practice of the theory of exercises. But also children (right down to the age of 10), with their readiness to follow the teacher, will like to feel themselves as his fellow-workers and responsible for their own work; independent work, it is agreed, develops the feeling of responsibility.

With mass exercises the free method should not be used too long; fairly soon the teacher ought to adopt one of the methods following. As regards individual exercises the case is different. These lend themselves to free work, and here the method should be used time after time. In these exercises the aim is to develop the strength of certain groups of muscles (*e.g.*, in an upward circling) or co-ordination (*e.g.*, in agility exercises, such as hand standing, "head spring," etc.), and for that purpose many repetitions are required.

Exercises taken "*by numbers*." The teacher takes an exercise by numbers when he commands each movement of the exercise, stops, corrects or repeats, so that the movement becomes an exercise by itself, so to speak. According to the free method, the pupils are working independently, trying to correct faults and to find the right positions. But now each part of the exercise is controlled by the teacher; he judges it, he determines whether the movement is to be repeated, he corrects any one pupil before the rest of the class, etc. And he demands the same of all at a given time; in other words, a simultaneous working together.

Exercises performed in "*individual time*" or "*individual rhythm*." Exercises taken by numbers give the pupils comparatively little work to do. This method should therefore not be used more than is absolutely necessary; as soon as possible the proper form for work, in time or rhythmically, should be adopted. In case the pupils have not understood an exercise fully or have forgotten the right way of doing it, the free method of working by numbers may be briefly resorted to.

When an exercise is done in time or rhythmically the one movement follows the other, according to a certain time or rhythm and during constant repetition till the word "Halt" is given or till the next exercise is taken up. By this method a given exercise may be performed a far greater number of times within a certain space of time than when the exercise is done by numbers. A greater training both of muscles and nerves is obtained, and pupils will soon have a feeling of warmth and well-being, bodily and mentally, which will increase their keenness, and which is a condition for their full benefit from the lesson.

The most suitable time or rhythm for the individual pupil depends on various circumstances and facts, particularly his size, his physical strength, temperament and his nervous reaction. A small person moves his arms, his legs, his trunk, more quickly than a big one; the same holds good for the physically strong compared to the physically weak, and the one who is able to react quickly compared to the one who reacts slowly. Consequently, it is right to allow beginners, whether children or adults, to work in their own time, *i.e.*, in *individual time* or *individual rhythm*. The various pupils will in this way get an opportunity of working with an exercise according to their abilities and strength, quite unhampered by those fellow-pupils who either cannot or will not keep up with the rest, those whom the teacher must constantly correct or for whose sake he often has to stop the exercise and begin afresh in his endeavour to make them keep up with the others.

It is a lightening of the work, both to teacher and to pupils, to put aside the old and too far-reaching demand of simultaneous work in all more or less important exercises. The daily work will now yield better results and will be more stimulating and attractive to the pupils. There is accordingly a difference between the daily work where the results are gained and a gymnastic display where the results are exhibited.

Exercises taken in "*joint-time*" or "*joint-rhythm*." As a pupil learns an exercise, *i.e.*, understands its correct form, has obtained sufficient strength, suppleness and control over the movements, his ability of working together with others is increased. And as it is more agreeable and stimulating to work in time with others, the pupil will adopt joint-time or joint-rhythm both as much by following his own desire as that of the teacher. A simultaneous working together has now been established, but of a different kind than the one which the teachers of old sought to enforce from the outset. When the pupil is capable of keeping time with others, the common rhythm will stimulate him to greater exertion and endurance, and train his nervous system in reacting precisely and under control. By demanding simultaneousness the ability to sense the rhythm and keep to it minutely is also developed, and this is a valuable part of physical education too.

Teachers, particularly those who are young, inexperienced and eager, must not be tempted to hurry the time too much. When the time is too quick the movements are not carried out to the full limit, and the effect, particularly as regards suppleness, is diminished. By over-much attention to life and speed the form of the exercise may be neglected. It isn't enough to set an exercise going. The teacher must constantly correct and instruct, whether the exercise is taken in time or by numbers. The full effect on the body is only gained when the exercise is done in correct form. Correction and instruction should be given without interruption of the exercise. The words used may be spoken in time with the movements, so as not to disturb the rhythm.

From personal experience the teacher should know the time and rhythm suitable to the various exercises. During work in individual rhythm he must help the pupil to find that speed which makes the exercise most effective. The keen pupils who are hurrying the time too much to allow them to go to the limit in each movement should be retarded, and the slow and lazy ones should be speeded up.

But when we come to exercises in joint-time the teacher's perfect knowledge of the rhythm suitable to the various exercises is of vital importance to secure efficient teaching. As the whole class has to work according to the same rhythm, he must find the time most suitable to the majority, a sort of average or normal rhythm. For those whose movements are naturally quick it is easier to lessen the speed than for the slow ones to increase it. Therefore the speed of the rhythm should be rather a bit below than above the average. A fairly slow rhythm leads to better results than a rhythm which is too quick, even if only slightly so. Whether he is teaching younger or older children or adults he must try to imagine how the exercise is being felt by the pupils. To do this effectively he should take any opportunity that presents itself of personally lining up as a pupil in the ranks.

In the gymnastic terminology the words rhythm and time are used at random. But there is a difference in the original meanings of the words. Rhythm comes from Greek (*rhythmos*—*rhein*, to flow). The Greeks used it about the regular movements of the waves, of movements done in time, such as dancing, but also of the rise and fall and harmony of the voice in free speech, and of the proper relationship between the details of a connected whole, *e.g.*, in sculpture. The word tact, the stroke in keeping time in music, comes from Latin *tactum*, to touch, to beat. Time is marked by strokes or beats by a stick, regular, uniform movements measuring off spaces of time, intervals.

In their present-day meaning rhythm and time are to a certain extent synonymous, both marking a certain regularity. But rhythm contains more than time. Time is, so to speak, the frame, rhythm the animated, the spiritual content. A metronome beats the time firmly and regularly, but the music is not rhythmical unless, besides keeping to time, it is animated, expressive, and instinct with feeling.

Nor in gymnastics are time and rhythm synonymous; also here rhythm contains more than time. Take, for example, marching. Beginners may soon learn to move their feet together, to march in time, but the movements may still be stiff, clumsy and heavy. The marching or walking is not rhythmical till the whole body is so trained and developed that all the movements are co-ordinated and the marching light, free and economical of energy. When introducing marching we first strive for time; the next aim, far more difficult to attain, is to make the marching rhythmical.

Not all mass exercises can be taken rhythmically, and one should not attempt to enforce rhythm in exercises that do not lend themselves to it. There are a number of exercises in which the pupils may work freely, repeating the movements as often as their strength will allow, *e.g.*, fall hanging, body raising; high and free front hand lying, arm bending; back lying, trunk bending forward, etc. Here we cannot speak of individual rhythm or joint-rhythm, hardly even about time. In arm stretching there is a marked time, but really no rhythm; because the movements are too jerky and not sufficiently connected. But rhythm may be spoken of in exercises such as stride standing, trunk bending sideways, and stride standing, trunk twisting, particularly when single arm flinging is added. When the extreme position has been reached in, *e.g.*, a trunk bending or twisting, rhythmical pulling (in order to bend or twist a little further) done in joint-rhythm may be of advantage. Rhythm is well marked in all kinds of marching and running exercises, not to speak of the various forms of jumping astride, jumping with straight knees, or hopping; but these latter are also closely related to dancing, which is the most rhythmical form of physical exercise, particularly when accompanied by good music.

Formerly teachers made the mistake of taking the exercises too much by numbers and repeating the exercises insufficiently when taking them in time. Now, on the other hand, many go to the other extreme of using the rhythmical way of working almost exclusively. Stopping in a position and holding it a moment should not be done away with altogether. It gives to the muscles static work which they ought to be trained in. Throughout the day we use static muscle work, often of a prolonged kind; and while some muscles are primarily destined for movement (*e.g.*, ilio-psoas), others have to maintain positions, and are therefore richly provided with tendinous tissue (*e.g.*, the hamstrings, the erector spinæ, the middle portion of the deltoid, etc.).

Furthermore, during rhythmical work the muscles will not work to their full extent; they will neither be fully shortened nor made to work with full power. A couple of examples will make this clear.

In drag stride lean standing, arm swinging forward-upward, the muscles swinging the arms forward-upward, strongly extended in the starting position, will by a smart contraction at the beginning of the movement give the arms such an impetus that they will swing through the latter half of the range without any muscular exertion. If they are allowed to swing back immediately without stopping in the stretch position the muscles previously mentioned get no opportunity of working in a shortened condition. The exercise will then make solely for suppleness, not for strength.

If, on the other hand, the arms are stopped now and then in the stretch position, these muscles will have to work hard against the elasticity of those that pull the arms downward and which have been extended by the arm swinging upward. The trapezius, one of the muscles swinging the arm up, ought, in most cases, to be shortened in order to keep the shoulders in their right position. Therefore the exercise is good for the carriage.

In hanging, high knee raising, the quick lifting of the knees will lessen the muscular effort in the latter part of the raising. The muscles which lift the knees will then get no opportunity of working in their greatest shortening, unless a stopping in the crook hanging position is demanded.

To secure harmonious bodily form, not only normal suppleness must be effected or maintained, but the different parts of the body must be kept in their proper related positions. Consequently, gymnastics must comprise both static and rhythmical work.

(*d*) The teacher must take care that *no dead points come into his teaching.* If the pupils are kept in constant activity, or, in any case, if their attention is held, it is much easier to maintain order and discipline. To have to wait in inactivity tempts the pupils to be inattentive and to play tricks. Scolding and punishments are not nearly so good a prevention against this as work.

Regard must already have been paid to this in the construction of the table (as explained on p. 18), and team division must be used in necessary measure. But besides this the teacher must be able to let the one command follow upon the other, and corrections and encouragements in connection with the commands must follow close upon each other; he must fill the room with his energy. The pupils feel immediately when the teacher hesitates, or is in doubt or unsure, and in that way he loses control over them. If it should happen that it is necessary for him to stop in order to reflect or consider, then he must be sure at once to command a rest, so that the pupils get a natural pause. In the same way the teacher must carefully consider his orders before he gives them, as it has a bad effect on the discipline to have to give a counter order.

(*e*) *Correction of Faults.* One of the most important sides of the teaching is the correction of faults, because the exercises are not only to have a recreative, but also a corrective effect; also the work of an exercise (that is, the amount of recreation it gives) is often greater when it is done with correct form than when it is done incorrectly, which last is, as a matter of fact, in many cases the same as to do it slackly. As stated on pp. 32 and 38, the teacher must have an eye for the correct form of the exercises, be able to see at once the departures from it—*i.e.*, the faults—and be able to distinguish between the important and the unimportant faults, of which the former must be corrected first.

In order to be able to see the faults easily the teacher must take care to stand in a position from which he can see his pupils clearly. In certain exercises the faults are most easily seen from the side—for instance, stretch lean standing position—in others from the front. Not a few exercises must be seen from more than one side if the faults are to be detected.

The way in which the faults should be corrected depends to a great extent upon the kind of fault and the type of exercise in which it occurs, and upon whether the faults are made by many or by few of the pupils.

If a fault is found in many of the pupils, the teacher must, as explained on p. 44, correct it by stopping the exercise and commanding a rest, after which he speaks about the fault in detail; he explains how it can be avoided, and he can, perhaps, using words suited to the comprehension of his pupils, make them understand what harm it does. For example, one can get even fairly small children to see the difference between an exercise done with round back and done with straight back, and get them to believe that the latter is much more beautiful and beneficial. With older children an explanation of the importance and effect of the exercises often helps greatly in maintaining their interest. The teacher can also make use of the vanity of the age of puberty by getting the pupils to realise that the best ornament is a beautiful body.—The explanation of the fault should, as a rule, be supported by an illustration of it.

Even if a fault in an exercise is in this way made clear to the pupils, they will, nevertheless, often make it. In such case, it is corrected by a short injunction while the exercise is being done (for instance: "Head up!" "Shoulders back!" "Stretch the knees!" etc.), as the pupils now only need to be reminded of it. Such corrections must be repeated constantly, and so emphatically that they are complied with. They must be given in a calm, decided, and encouraging manner, never with offensive or scolding words or in an angry, sulky tone. The exclamations may apply to all the pupils, but if they are especially to concern certain ones, the teacher must let these feel it by looking or pointing in their direction, by mentioning their names, etc.

Often it can be of advantage if the teacher supports his verbal corrections by going quickly from one to another of his pupils while still continuing his commanding or verbal teaching, helping with his hand those whose faults are especially pronounced, or in any other way bringing them into the right position.

The corrections which are given during the performance of an exercise while the pupils are standing in difficult and strenuous positions must be of very short duration, otherwise the pupils will be tired and the position slackened; this also will be the case with those pupils who have hitherto performed the exercise correctly, so that there are more faults caused than are corrected. Therefore the teacher must take especial care that correction by touch is not used too much, as this takes a comparatively long time.

At times it may be useful to let the older pupils in pairs correct one another.

Some faults also can be corrected with advantage by letting the pupils correct themselves. In this way during a stretch position one may let them look up at their arms, so that they themselves become clear about the faults and can correct them. In this way their muscular sense is trained and they gradually get a physical impression of how the various parts of the body stand in relation to each other. In addition, it is much easier to convince the pupils about their faults when they themselves have a chance of seeing them. Unfortunately, there are only comparatively few exercises during which the pupils can in this way correct themselves, unless there are in the gymnasium mirrors so arranged that the pupils can see themselves from all sides, a thing which should be aimed at.

If such serious faults occur in a single pupil that they cannot be corrected during the performance of the exercise, then the teacher must not let all the other pupils wait while he corrects that one. He should, on the contrary, help such a pupil in a free moment after the lesson, or during team work or the like, while the others are at work.

The teacher must watch strictly that what he has commanded is fully carried out. If, for example, during a vault he has said that the pupils must remain standing where they land in the erect position or in the landing position, that they must take a full knee bending in the landing, that they must go a certain way back to their places, etc., then he must interfere the first time that anyone transgresses his order. Otherwise the children get a feeling of uncertain management, which undermines the discipline.

The teacher must distinguish with great accuracy between inability and unwillingness, or perhaps even obstinacy, in his pupils. Lack of ability must not be considered as an error, to be treated with rebuke or punishment, but as something which can be improved by practice, by sympathetic and encouraging help, and by correction. To claim of the pupils what is beyond their strength undermines the discipline. With pupils in the age of puberty special regard must be paid to irritability and lack of mental balance; reproach and reprimand, then, should be given privately, and the teacher will find it best to treat his pupils more as adults than as children, as he more easily wins their confidence and affection in that way. Gymnastic exercises must never be used as a punishment.

(*f*) *Team Work.* As was emphasised on pp. 18 and 53, it is an important rule in the teaching of gymnastics that the pupils must be kept in regular and constant work. This is easy enough with mass exercises, either with or without apparatus, but it becomes more difficult with individual exercises, certain heaving exercises, balance exercises, jumping and agility exercises, which can only be taken by one pupil at a time. It is therefore necessary with these exercises to divide the pupils according to the size of room and class into two to six teams (or squads), with six to ten pupils in each team. At the head of each team is put a team leader, whose work it is to conduct the team to the place where it is to work, to look after the taking out and replacing of the apparatus, to conduct the exercises and see that the standing-by is done satisfactorily.

During team exercises the teacher supervises all the teams, going from one to the other, and giving help where it is needed. If a team has to learn a difficult exercise, then it may be best for him to keep mainly to this team; he must then stand in such a place that he can easily see and keep his eye on the other teams.

In the case of team division for heaving or balance exercises, the teams should not change in one lesson; they may, on the other hand, change from day to day, but as a rule it will be better to let each team work for some days at the same exercise, so that it is thoroughly introduced. With vaults and agility exercises, which are taken, as a rule, at the same time, teams must be changed, on the other hand, two or three times in the same lesson, so that each team gets, as far as possible, both jumping, vaulting, and agility exercises, preferably a couple of vaults. The teams, however, especially in the case of untrained pupils, must not change too often; only enough to give every pupil a chance to practise each exercise a suitable number of times. Conversely, too frequent repetition does not assist, for fatigue to a great extent lessens the power of co-ordination; the result is that the pupils perform the exercise worse and worse.

The teacher must keep account of which exercises the various teams took last, so that in the following lesson they can begin at the right place. During team exercises the teacher occasionally should let one team perform an exercise a couple of times with the other teams as spectators. Then he not only expresses his own criticism, but can let the pupils in the other teams also give their opinion about what was shown; in this way their faculty of observation of the correct form and the faults is trained, and this will increase their understanding and interest. In the same way it is good to let the teams compete in quickness, with the teacher keeping the time—for instance, with vaults in stream.

When the gymnasium is large enough and well enough supplied with apparatus, the teacher can and should conduct the teams himself fairly often, letting them take different degrees of the same exercise on the same or nearly similar apparatus (horse, buck, box, beam saddles). In this way he gains variation; also the possibility of being more intimate with the performances, and especially of correcting more.

(g) *Order in the Gymnasium.* It is of importance not only for discipline, but also for training a sense of order in the pupils, that the teacher should be careful to keep thorough order in the gymnasium. In the apparatus rooms each piece of apparatus must have its definite place; the pulling rope, swinging rope, jumping rope, etc., must be properly coiled up; the mats must hang in their places. Further, it is a part of good order that all which concerns the pupils in keeping the gymnasium clean (changing of shoes, swabbing, etc.; see pp. 65 and 66) is strictly carried out.

When apparatus has to be brought out or taken away, the teacher must first appoint those who are to do the work, and assign to each that part of the work which each is to do. It is often useful to let the pupils take their positions—for instance, at the beams, horse, mats—and first begin to move them when the teacher gives the signal. The teacher in this way is able to make the children accustomed to working together, and, for example, avoids seeing the pupil who comes first dragging the mat after him; if the apparatus is heavy, the moving of it goes much more surely and easily when all take hold at the same time. The time used for arranging the apparatus must not be looked upon as wasted; it is good to train the pupils to be practical in such work. In the same way, care must be taken that the pupils go nicely to and from an exercise; that they do not knock or push one another in running to and from position at the apparatus; that they do not run between the teacher or team leader and his team; that they go behind, not in front of the teacher; and that they behave well under all conditions, especially when they are not directly under command of the teacher.

(h) *Precautionary Measures.* The teacher is responsible for the necessary precautions being taken to prevent accidents, whether he is teaching swimming, gymnastics, or games. As regards the gymnastic apparatus, the teacher—preferably the oldest, where there are several—must make sure that it is in satisfactory condition—for instance, that the ropes for hoisting the beams are not worn—and he must draw the attention of those concerned to anything wrong.

In the lesson he must see that the bolts are put under the beams before they are used, that the children do not stand under the beams or any other heavy apparatus when it is being moved, and that there is sufficient standing-by for new or difficult exercises; as regards this last point, however, he must aim at making the pupils gradually accustomed to rely on themselves as much as possible, so that it does not become a habit with them to have to be helped; the more gradually the teacher advances the less necessary standing-by is.

(*i*) *Teaching of Infants.* The above rules apply to all teaching in general. With children of 6 to 8 years there are some special points which have to be taken into consideration in the teaching. As regards gymnastics, we have mainly to consider how the teacher has to explain and command the exercises.

The teacher should, by his explanations of the exercises, try to put the children's imagination to work so that they are attracted and interested. If, for instance, they are to have long jump over two chalk lines, then the teacher may tell them that while going to the forest they come to a ditch full of water which they must now try to get over, as otherwise they will get wet feet and have to go home to change their stockings. The more pictures of this kind he can bring into his teaching, using few and easily comprehensible words, the more joy he will put into the work.

Those movements which cannot be explained in this way by pictures must be taught first and foremost by illustration. Often the teacher must not only show an exercise himself, but afterwards let one of his best pupils show it again, so that the children can better grasp it.

Most of the ordinary words of command cannot be used for infants. The explanatory words must often be a short description of the exercise which has been shown; sometimes the illustration can even take the place of the explanatory words if it can be given while the children are standing ready to perform the exercise. As an executive word, a word (now, come, begin, etc.), a sign, a whistle, or a clap can be used.

From the beginning the teacher should lay great stress on training the sense of rhythm and time in young children. He can count the time energetically and distinctly, and later let the children themselves count aloud, taking care that they pronounce the numbers clearly and sharply, and not in a slovenly or dragging manner. He must also see that the emphasis is put on the number corresponding to the most important movement of the exercise. For such a movement a special word, in place of the number, may be used. If, for example, during marching they are counting for the halting, instead of saying *one!—two !* after the teacher's *halt !* they may say *one !—stop !* When the children begin mastering the time, singing or humming easy and catchy tunes to the exercise may help in a further training of their rhythmic sense.

(*k*) *Exemption from Gymnastics*. The teacher should work in concert with the school, college, or institution medical officer, and the latter's recommendations or orders following entrance, periodical, occasional, or special examination of pupils must be adhered to consistently. Where possible, the teacher responsible for physical training should attend the S.M.O.'s examinations.

On request from a parent or guardian the head master or principal may exempt a pupil from part or the whole of the physical work, and the teacher of physical training must be careful to be particularly loyal and avoid a possible cause of unpleasantness between the home and the school.

In cases of temporary indisposition, physical incapacity, deformity, etc., the teacher must use a careful discretion and display a ready sympathy, but this must not be capable of interpretation as softness or weakness.

It is, of course, of importance that the pupils are not temped to apply for exemption from gymnastics in greater measure than necessary. The teacher must try to make the children enjoy their gymnastics. Good and lively teaching is first and foremost necessary, but such things as care in keeping the gymnasium clean and good airing of the gymnasium and changing rooms (see p. 66) are also important. In the next place, the teacher must remember that the children vary very much in strength and endurance—in short, in all their health conditions. In this direction, too, he must learn to know his pupils, so that in time he can judge how each should be treated. If there are exercises which are not suitable for some of the pupils, he must excuse them from these exercises or give them others instead. In the age of puberty, for instance, where, as mentioned on pp. 28 and following, special care must be taken with exercises which restrict the breathing and claim strong exertion of the heart, there might in addition be reason to excuse some of the pupils from exercises which the others could quite well perform. Besides this, the teacher must pay regard to the nervousness and timidity which is found in some children, and not demand of such children that they should work on high apparatus and do exercises of which they are specially afraid. He must try, by using the progression of exercises which suits them, to give them courage.

§ 8. Commanding

A command states in the shortest possible form both the exercise to be done and when it is to be done. It therefore consists of two parts : *the explanatory word(s)* and the *executive word.*

The *explanatory words* should contain short and clear information as to which exercise should be performed and in what way it should be done (freely, by numbers, in time, rhythmically, slowly, quickly, etc.).

The teacher must give the explanatory words loudly and distinctly, as a rule slowly, in order to give them emphasis. He must put energy into his words, and so influence his pupils to put energy into the exercises. Each word should be pronounced correctly, though with rather more emphasis than is usual upon the separate syllables, and in a tone between speaking and singing. This tone must, above all, not be monotonous or dragging, as then the command would have a slackening effect and make the work wearisome. The teacher must be able to alter the tone of voice even for the same word of command if this is often repeated. Finally, the rhythm and character of the exercise must be shown by the expression of the explanatory words ; one must be able to hear whether it is a slow or quick movement which is to follow.

The *executive word* gives the moment at which the exercise is to begin. It must be a short word, preferably of one syllable, which can easily be pronounced distinctly. It is given differently according to whether the exercise should be a quick or slow one. In the first case it must be given as shortly and distinctly as possible, the tone of voice being raised. In the latter case the voice should be lowered and the word said more slowly, being drawn out a little, but even this kind of command must be said with emphasis and energy.

It is not sufficient, however, that the executive word should express the difference between very quick and very slow movements only (for instance, hips—firm, as compared with backward—bend). It must also express all of the many transitional forms which lie between these two extremes. This difference in expression is necessary partly to teach the pupils the speed of the movement, and partly to keep in training their sense of time and to prevent monotony in the commanding.

The following can be mentioned as examples of difference of speed in movements. Arm stretchings are decidedly quick exercises, foot placings are somewhat slower, lungings are a degree slower still, and lastly trunk bendings are decidedly slow exercises. This difference in the speed of the exercises must consequently be expressed by the different way in which the executive words are given, from a short and sharp "stretch" to a slow and singing "be—n—d."

Between the two parts of the command there must be a *pause* in order that the pupils can prepare for the exercise which is to be performed. It is naturally only an inward preparation which must take place ; outwardly there must be no movement. The strength is collected and ready, but bound until the executive word releases it.

There is no small amount of self-control necessary for an unpractised teacher to keep the executive word back long enough. It often slips out of his mouth without his knowing ; as a rule, he gives the whole command in one breath, and is then forced to hurry with the executive word while there is still some breath in his lungs. The best way to cure this fault is therefore to draw a breath after the explanatory words. By this he is, in addition, able to give the executive word with greater strength and decision, just as he can more easily pronounce a difficult word correctly.

The pauses between the two parts of the command must by no means always be of the same length. In the first place, they must be longer with beginners and infants, because the exercises are to them strange and less known ; therefore they need more time for preparation. In the next place, even with more practised pupils there must be a difference in the length of the pause, so that they may not be able to conclude when the executive word is coming and begin the exercise too early; in this way simultaneousness is spoilt and the pupils do not learn to control themselves. It is in reality a very common fault that the teacher makes the pauses of equal length, and thus comes to command in a certain rhythm. It often even goes so far that the exercise begins before the executive word has been given, because the whole class knows the rhythm; the teacher then has to hurry to give the word, and thus it comes to be the pupils who draw the teacher with them, and not the other way about, as it should be.

Exercises consisting of more than one movement may be taken in four different ways (see pp. 47 and following): *freely*, *by numbers*, in *individual time* or *individual rhythm*, and in *joint-time* or *joint-rhythm*.

When the pupils have to work *freely*, the teacher simply gives the order "work freely."

When an exercise is to be taken *by numbers*, the teacher may use a complete command for each movement (*e.g.*, arms—bend! arms upward—stretch! arms—bend! arms downward—stretch!), or he may use the explanatory words which apply to the whole exercise, followed by the words "by numbers" and as executive words the numbers needed (*e.g.*, arm stretching upward by numbers—one!—two!—three!—four!).

If the pupils have to work in *individual time or rhythm*, this may be indicated by adding to the command or the order "in individual time" or "in individual rhythm."

A similar addition may be made in the case of joint-time or joint-rhythm.

It is of great importance that the teacher distinguishes clearly between the use of numbers as executive words and the so-called time counting. When the movements of an exercise have been learnt by numbers and the exercise is taken in time or rhythmically, time counting may be used in order to help the pupils to keep together. The words "in time" precede the explanatory words and the executive word may be *begin!* or *go!* or *jump!* etc., according to the exercise. When numbers are used as executive words (for separate movements of an exercise taken by numbers), they must, of course, be said *before* each movement, and not in a certain rhythm after one another (p. 48), while, when time counting is used, each number is given just at the *end* of the movement, and, as its name implies, in an absolutely fixed rhythm.

When an exercise is to be *repeated* it is not necessary to give the whole command again, but the word "repeat" is used as the explanatory word and as executive word the various numbers, exactly as explained before when dealing with the performance by numbers of exercises consisting of more than one movement.

If the exercise is to be performed in time the command may be: "Repeat in time—go (or begin)!" The exercise is then stopped by a "Halt!"

In order to get the pupils quickly into a starting position two exercises are often joined in one command, and are then performed simultaneously. This, however, cannot be done before each of the exercises has been introduced alone. The command then consists of the explanatory words for both exercises and the executive word for the last, For example, one may command, "Feet close and arms—bend!" instead of command first "Feet—close!"; and after that "Arms—bend!" The same can be done when each of the exercises consists of more than one movement; for example: "Feet astride and arms upward—stretch." If one of the exercises consists of a single movement and the other of two, the first is taken together with the second movement of the latter, and the single movement is put first in the explanatory words; for example: "Left foot forward, arms upward—stretch!"

Besides the form of command described above, a form which is used when the exercises must be performed quite simultaneously and with full precision, another form, a simple *order*, is used. Here one does not distinguish between explanatory word and executive word, because no simultaneous working is demanded (*e.g.*, "numbering by twos!" or "apparatus ready!").

The rhythmical way of working which is used extensively, and rightly so, has resulted in a quick transition from one exercise to another, often without stopping. In that way time is not wasted as formerly, when one made each exercise finish in the erect position and the following begin from the erect position. The consequence is that the simple *order* has become the most common form of command. While one exercise is being performed the order for the following is given and the transition from the one to the other is marked by words such as *now !—go !—begin !*—etc. Till this word has been said the work with the former exercise goes on undisturbed.

The teacher must give the order for the new exercise in such a way as not to disturb the rhythm of the exercise with which the pupils are working.

About commands for exercises with young children, see pp. 58, 59.

It is especially by means of his commands that the teacher exercises an influence over his pupils and brings them under his will. It has been said aptly that a good command is the exercise half done. In his commands are reflected his personality, energy, keenness, and interest, and through them all these are transferred to his pupils. The pupils, in their work in the gymnasium and in the playground, are the expression of the commanding and management and the whole of the teaching generally.

There is reason to draw attention also to the fact that the teacher, by means of careful commanding, can develop his power of speaking distinctly. In order to be able to pronounce a difficult word correctly and clearly, the muscles which are concerned in speech must be trained to work with sufficient speed and exactness. The pronunciation of a word is in reality for these muscles a co-ordination exercise of the same kind as the co-ordination exercises in gymnastics, and a co-ordination exercise is learnt in one way only namely, by persevering practice and many repetitions. The mode of progressing with the introduction is also the same in this case ; just as one divides a difficult exercise into separate parts and teaches each part separately, in the same way one can practise a difficult word by first practising the separate syllables sharply and distinctly, and by saying the word slowly before saying it quickly. Such practice in saying a word of command clearly and correctly can help to make the ordinary speech correct, distinct, and easy to "catch," which is of great importance to a teacher if by his teaching he is to induce his pupils to follow him and be attentive.

§ 9. Gymnasium and Apparatus

The gymnasium should be twice as long as it is broad ; otherwise its size must be according to the size of the school.

In schools with about 150 children the gymnasium should not be less than 50 feet in length, 25 feet in breadth, and 16 feet in height, and for bigger schools not less than 64 feet by 32 feet by 18½ feet.

The gymnasium should lie in such a position as to admit the greatest amount of sunlight. The entire area of glass in the windows should be one-sixth of the floor area. The windows should be in the long walls, their lower edge at the height of the wall bars; if they cannot easily be reached from the floor, they must be arranged in such a way that they can be easily opened from the floor. It is only when there are windows in both sides of the gymnasium that it is possible to renew the air in a moment during the exercises, and this is of material importance.

The position of the windows must be arranged according to where the fixed apparatus ought to stand, as the beams can only be solidly placed up against a wall pillar.—If the girders of the roof protrude from under the ceiling, the position of these must also be taken into consideration.

The walls must be so high that the roof can be flat all over the hall. This is of importance for the right placing of some fixed apparatus (beams, climbing ropes, square ladders, etc.).

In the *floor* the boards should lie across the room, as the pupils then are less inclined to glide in the running and take-off, and the danger of getting splinters in the hands from a fall is also considerably less. The floor must be kept well varnished, and if cracks open between the boards they must be filled with putty, as otherwise dust collects in them and is thrown up by the vibration of the floor.

In building the gymnasium we must avoid surfaces which face upward, on which dust can collect and from which it is whirled down when the air is moved. All corners must be rounded or filled out with sweeping lists in order that the room can be kept clean.

The *colour* of the walls and ceiling of the gymnasium should be light.

It is necessary that there should be a *changing-room* and an *entry*, in order that the pupils may never enter the gymnasium without clean gymnastic shoes. In the entry the children should be able to put their footwear, if necessary, on shelves; in order that it may not get dirty there should be a scraping mat either in the entry or just outside, and preferably also a large floor mat inside the door. The door from the entry to the changing-room must be as far as possible from the entrance door. It is necessary to have a door opening directly into the gymnasium from the entry, but this must be closed to the pupils. The changing-room should be supplied with the necessary forms, pegs for clothes, and cupboards for shoes and gymnastic dresses (the children must not take their gymnastic shoes home, as they then easily come to be used out of doors and are thus made dirty). In gymnasiums which are much used and where one class comes immediately after another, there should be two changing-rooms.

In addition, for each gymnasium there should be an *apparatus-room*, as otherwise the large pieces of apparatus, such as horse, box, buck, mats, etc., take up too much space in the gymnasium. and prevent proper cleaning and free movement.

After each gymnastic lesson the pupils must be able to have a shower bath. Consequently, there should be a *bathroom* with shower baths in connection with the gymnasium.

The most important objection to gymnastics is that it takes place indoors ; therefore we must take care to keep the air in the gymnasium as clean and fresh as possible. It is of extreme importance that the gymnasium be *kept properly cleaned.*

The floor in the gymnasium and in the rooms in connection with it should be washed once a day, or at least a couple of times a week, according to the use which is made of the gymnasium, and at the same time all the wooden apparatus, window sills, etc., should be wiped with a wet cloth. If the gymnasium has been used for a meeting, a dance, or the like, it is absolutely necessary that it is well cleaned before any gymnastics are performed in it. All cleaning must be done with the windows open.

The mats must now and then be taken out and well beaten. Cocoa mats do not give nearly as much dust as stuffed mats ; the latter should therefore be avoided. In addition, cocoa mats can be cleaned by rinsing ; this should be done a couple of times a year.

At least once a year the gymnasium and rooms connected with it should be given a thorough cleaning.

A very important means of keeping the gymnasium clean is swabbing. This should be done (by the pupils in turn) before leaving the lesson, with a broad swab which is pushed from behind. There must be a trough for the swab, which should preferably be cast in the underlying concrete under the floor in the apparatus-room, changing-room, or entry, and which should be arranged so that there is an outlet at the bottom of it and a tap above it.

Before and after the lesson and during the lesson, while marching and running are taken, the gymnasium should be aired.

The use of resin and especially chalk must as far as possible be avoided, as they give dust.

The children must not be in the gymnasium in the intervals, except in wet weather, and then only if no other rooms can be used. They must change their shoes before entering the gymnasium, as before a gymnastic lesson.

The *temperature* in the gymnasium should not be less than 8° to 10° Celsius; it is therefore necessary that the room should be heated in the winter. The changing-rooms should also be heated. Ordinary stoves cause a lot of dust. Central heating is therefore preferable.

Apparatus. The free standing exercises are certainly of great importance for many reasons. They are effective, the whole class can work at them at the same time, and, what is of importance, they can be done outside the gymnasium. We really ought to get so far that the free standing exercises become so well understood and habitual that the pupils take them with them from school, and, later in life, every day devote some few minutes to keeping their bodies healthy and supple by means of these exercises. But in spite of all these good points in the free standing exercises, we cannot, of course, in the teaching of gymnastics be content to use these alone. Without apparatus the development through gymnastics of strength, agility and courage would be practically excluded; also we should not be able to make so much use of that driving force, the spirit of competition.

One point about the apparatus is that is has to be used by many at the same time, and for so many different exercises that both the weak and strong pupils can use it. Further, it is of importance that the apparatus be so arranged that it can all easily be brought forward for use and easily taken away again, so that the whole of the floor is free. In the last place, its expensiveness must be taken into consideration.

The best piece of apparatus is, beyond comparison, *the beam.* There should be so many beams that there can be 2 feet for each pupil—in general, that is, two or three sets of beams across the room with a centre upright. The beams should not be more than 15 feet long, as otherwise they must be made too heavy, both in order to be sufficiently strong and in order not to sway. They should be counterbalanced and the upright arranged so that it can be drawn to the wall; the beams must be arranged so that they can so easily be taken out for use and taken away again that the teacher will think nothing of using them several times in the same lesson. Although single beams are most used, double beams should not be lacking in any gymnasium. The beams can be used for a number of exercises—heaving and balance exercises, many jumps and vaults, some span bendings, and some good trunk exercises.

There should be so large a number of *wall bars* that there is a section for each child in the class. In gymnasiums where economy is necessary the number can be lowered just as well to half as, for instance, to three-quarters, as the pupils must in any case be in two divisions for exercises at them.

In connection with the wall bars there must be *stools* (one to each section) and a suitable number of benches, narrow and flat on top and with a "runner" for balance exercises underneath.

There must be so many *climbing ropes* that there is one for every three pupils in the largest class—*i.e.*, eight to twelve ropes.

Of other apparatus there should be: *Horse, buck, box, jumping stands, square ladders, oblique ropes, beam saddles, agility mat, cocoa mats, swinging rope, pulling* (*tug-of-war*) *rope, skipping ropes.*

Spring-boards with a spring should not be used, whereas a firm spring-board (*i.e.*, a "beating" board) can be used under certain conditions.

A *special costume* for gymnastics must be strongly recommended for boys—for girls it is necessary. It allows of freer movement, and it is hygienic to change clothes when one is warm and perspiring from gymnastics. Further, a special costume saves the daily clothes, and the air is more easily kept clean where it is used; an amount of dust and fluff falls in the gymnasium from the children's ordinary clothes.

Boys need only wear short drawers and shoes if the gymnasium is warm enough. The air bath which they obtain in that way is invigorating and hardening.

§ 10. Terminology of Gymnastics

The description of an exercise in gymnastics, as a rule, especially as far as all the less complicated mass exercises are concerned, is made up of one or more words which state the *position* (*the starting position*) from which the movement is taken, and a word or phrase which states the *movement.* In "standing, heel raising," "heel raising" indicates the movement itself, "standing" (really erect standing position—*i.e.*, attention) indicates the position from which the heel raising is taken and which is again returned to. In "bend arch stride standing, arm stretching upward," "arm stretching" indicates the movement, but as that can be taken in several directions, "upward" must be added in order to show the direction claimed in this case. "Bend arch stride standing" shows what positions the various parts of the body are to be in before the arm stretching is taken; "bend" states the position of the arms, "arch" the position of the trunk, and "stride" that of the legs.

After the name of the exercise is added here in brackets the name of the *position* to which the movement leads, though this is, as a rule, only added when this position can be a starting position for a new exercise.

The following examples show how the position reached by one exercise can be the starting position for another :—

Example 1

Standing, arm bending.	Bend standing position.
Bend standing, arm stretching upward.	Stretch standing position.
Stretch standing, trunk leaning forward.	Stretch lean standing position.

Example 2

Standing, heel raising.	Toe standing position.
Wing toe standing, knee bending.	Wing spring standing position
Bend spring standing, arm stretching upward.	Stretch spring standing position.
Stretch spring standing, arm parting.	Yard spring standing position.

The description of the exercises gives only the movement from starting position to final position, not the return movement to the starting position, for this, as a rule, goes back the same way. The name is thus, wing standing, trunk bending backward, and not wing standing, trunk bending backward and trunk stretching upward. We say standing, arm stretching upward; and not standing, arm stretching upward and downward. If it does happen that the return movement is taken in a different way this is stated in the description; for instance, standing, arm raising forward—upward, lowering sideways—downward. Those parts of the body which are not mentioned in the name of the exercise are kept in that relation to each other which they have in the erect position.

In some exercises, for the sake of brevity, details which are a matter of course or are generally recognised are not included in the name. For example, *marching* means, when nothing else is said, *marching forward in time*. Most jumps and vaults are taken with a run, therefore this is not given in the name; whereas if a jump or vault is to be taken without a run, *standing* (st.) is added to the description.

Stride standing position, bend standing position, yard standing position, etc., are in the text abbreviated to stride standing, bend standing, yard standing, etc.; arch hanging position, fall hanging position, balance hanging position, etc., can be abbreviated to arch hanging, fall hanging, balance hanging, etc.

A vault can often be taken on different pieces of apparatus or one piece of apparatus in different positions, by which the character of the vault is somewhat altered; the apparatus or its position must then be stated in connection with the description of the exercise. For example :—

Overswing (hand spring) with bent arms.	Apparatus crosswise.
Overswing (hand spring) with bent arms.	Apparatus lengthwise.
Stride vault.	Apparatus crosswise.
Stride vault.	Apparatus lengthwise.

The technical terms used to describe the various positions of the body are given at the back of the book in alphabetical order, with a short explanation to each, while otherwise reference must be made to the illustrations and the complete explanations to be found in the special part of the book.

II. SPECIAL PART

§ 11. The Back

The development of the back is the essential point in the physical development of the whole body.

It is the fundamental principle in Ling's (Swedish) gymnastics.

In order to understand completely Ling's exercises for the back, it is necessary to know something of the development, structure and function of the back. Therefore, an account of the structure and importance of the back is given as an introduction to the special gymnastic theoretical explanation of the individual exercises for the trunk.

The spine is very *complex* when compared with the other big skeletal parts. This is necessary in order that two quite different qualities, which as a matter of fact oppose each other, may be provided ; it must act as a *column*, not in one position only, but in many ; therefore it must also be *mobile*. There must be both *stability* and *mobility*.

The flexible part of the spine, which lies between the head and the sacrum, is not much longer than the femur. Unlike the latter, it consists of 24 bones or vertebræ. Every vertebra is complex, for, besides its body, it has 7 processes, of which 3 serve as fixed points and levers for the posture- and movement-muscles of the back, and 4 as articulations which control the movements of the back. The 24 vertebræ have, then, altogether 168 processes.

While the femur takes part in forming only 2 joints, the back has 95 *joints*, namely, 1 neck joint, consisting of 7 small joints, 44 joints at the articular processes, and 44 joints with the ribs. Of the latter joints almost half are double, being associated with 2 vertebræ. Besides these there are 23 movable symphyses between the bodies of the vertebræ.

The joints of the limbs have but few ligaments to hold the bones together ; yet between the 24 vertebræ there are about 400 ligaments. The vertebræ are so strongly connected that it needs very great strength to displace them from their correct position.

The fewer movements a joint can perform, the fewer muscles it has; conversely, the more movements, the more muscles. The elbow joint, which can only move in one plane, bending and stretching, has only 3 or 4 muscles. The back, which by co-operation of its many joints is able to move in almost all directions, has an extraordinary number of muscles—about 400 muscles or muscle-endings attached to its 168 processes (especially to the 72 muscle processes, but also to the 96 articular processes). These muscles run in all directions between the horizontal and vertical. Some are so short (1-2 cm.) that they only pass over one joint, others so long that they stretch over half the length of the back.

In the multitude of positions which the back can adopt, it has to be fixed with great strength so that in each of them it can form a firm supporting column. Think of the loads which can be lifted from the ground or carried on the shoulders, that is, borne by the upper portion of the long, flexible column. The muscles of the back are not only many, but in combination they are extraordinarily strong. Next to the muscles of the upper leg and hip, those of the back are the strongest in the body. Because of this power we are able to adjust the back quickly, accurately, and with sufficient strength, according to the different positions and movements which life involves. The back takes part in all of them. A hand or foot cannot be moved without the muscles of the back being involved and providing it with the right adjustment. *The spine, lying hidden in the mid-line of the trunk, is the centre for all our movements and forms the basis and starting-point for them.*

Twenty-four vertebræ with 168 processes, 118 joints (95 ordinary joints and 23 symphyses), 400 ligaments and 400 muscles—these figures indicate how complicated a mechanism the spine is. This mobile column is in its structure and function a masterpiece of mechanism, the equal of which cannot be found in the inanimate world.

But in one respect it shares conditions with complicated inanimate mechanisms—it gets out of order easily. *No other part of our body is deformed as often as the back.* It is not because there are faults in its structure, or because it is built of poor material, but only because *we treat it badly and tend it poorly.* It is not easy to understand that the enlightened civilised man deals so stupidly and carelessly with the precious mechanism of his back. He does not take care of its normal development during growth, nor maintain it when it is full-grown. The limbs, the periphery of the body, are taken care of much better than the back, the centre of the body.

Each component part of the spine has its characteristics.

The superimposed *bodies of the vertebræ* forming the column must be strong and capable of supporting a great weight, but they must be light, too, in order not to increase the weight of the body unnecessarily. Consequently they consist of light and spongy (porous) bony tissue, thus combining strength with lightness and differing from the compact substance found in the shafts of the long bones in arms and legs. When well

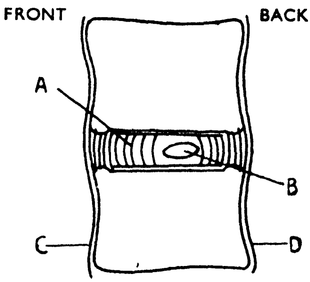


FIG. 1.—Diagram showing vertical section of two vertebræ and disc. A: external portion. B: pulpy portion. C: anterior common ligament. D: posterior common ligament.

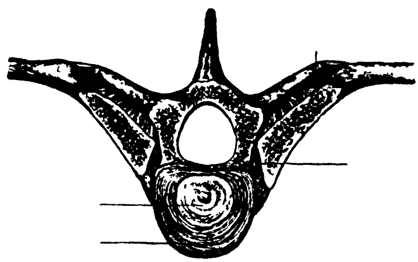


FIG. 2.—Horizontal section of a vertebra showing the disc with external and pulpy portion, laterally two ribs each with two articulations, one with vertebral body and one with transverse process. The joint cavities are seen.

developed they are, in spite of their lightness, sufficiently strong and have a good power of resistance; but if stunted in development—by faulty nourishment before birth and during the years of growth, by too much or too little physical work, by illness, etc.—their power of resistance is diminished, and the consequence will be deformity, more particularly wedge-shape (see Fig. 196) resulting in faulty carriage such as round back and scoliosis, both very common. *No faultless back will be secured without adequate nourishment and the right use of the spine during growth.*

The intervertebral discs (Figs. 1 and 2) firmly unite the vertebral bodies. It is to them that the mobility of the spine is due. The joints formed by them are different to other joints but have, however, certain features in common with them. The discs consist of two parts: the *external or laminar portion* and the *central or pulpy portion.* The external portion corresponds to the capsule in other joints; it forms a ring of concentric layers of fibrous tissue binding the vertebral bodies together. The pulpy portion corresponds in a way to the joint cavity and is situated almost in the centre of the disc. This pulpy part may be compared to a ball in a ball-bearing; it forms a shiny white cushion, tense and swelling from its liquid contents; it is resilient and capable of resisting very great pressure; but it is able to alter in shape and may be replaced during the movements of the spine, always in a direction opposite the movement: forward during a backward bending, backward during a forward bending, to the opposite side during a sideways bending.

If the ossification of the vertebræ has not been completed or is incomplete owing to wrong composition of the food or to ill-health, the compact but thin bony plates covering the vertebral body above and below may not be able to withstand the pressure of the central pulpy portion during heavy work such as lifting heavy burdens; it gives way, and the pulpy portion will force itself partially into the spongy tissue as a kind of rupture (hernia) (Fig. 3); the intervertebral disc thereby loses in thickness; the vertebral bodies are brought nearer together, the height of the body is decreased, and the mobility is reduced. A deformity has consequently set in in this region of the spine. It is apparent that food, rightly composed, is of vital importance to the back during growth, and it will also be seen how hard work, the lifting of heavy burdens and over-exertion, may be very harmful to the back during growth, particularly during the age of puberty.

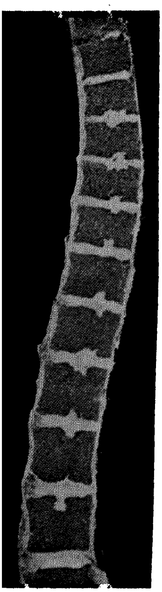


FIG. 3.—"Rupture" (hernia) in the spine of a man aged 25 years. The pulpy portions of the discs have pressed themselves into the spongy tissue of the vertebral bodies. The discs have become thinner and the bodily height has decreased. Here "rupture" is found in a series of vertebræ; it is often limited to one or two vertebræ.

The body bears on the dorsal side the *neural arch*, three processes for the attachment of muscles, and four articular processes. The first-named processes form levers for the strong muscles attached to them. The spinal processes of the dorsal vertebræ may alter in shape. When the spine is bent forward they are raised; and if it be continually bent forward as in round back, the spinous processes give way little by little to the downward pull of the muscles; they will take up a more oblique, almost vertical, position. When that has happened the round back will be fixed and cannot be corrected.

The mobility of the back is due to the intervertebral discs, but it would be uncontrolled mobility were it not guided and limited by the joints formed by the articular processes. The object of these joints is then to limit the movements and to determine their direction. This is one of the characteristics of the back, because in other parts of the body the movement, not the limitation of movement, depends on the joints.

The thicker the discs are, the more mobile is the back, but it should not be equally mobile in all regions. The neck and the lumbar regions with their thicker discs should be more mobile than the dorsal region. With age the thickness of the discs decreases, particularly owing to a drying up of the pulpy portion, and the back becomes stiffer. This cannot be prevented; but one may counteract and defer this stiffening by exercises moving the back to the limits of its mobility. It is consequently of great importance to keep the back in good order as late in life as possible.

The curves of a normal spine, the so-called *physiological curves*, are due to the discs which are slightly wedge-shaped where necessary. This fact ought to be emphasised because of the common assertion that the curves are due to wedge-shape of the vertebral bodies. Healthy, well-developed vertebral bodies are not wedge-shaped with the exception of the 5th lumbar vertebra, which is always wedge-shaped (not in native races, however, who habitually sit in a squatting position). The curves enable the spine to give way, like a spring, to pressure, shock, fall, etc., which is quite necessary for the sake of the brain in particular.

Now let us see how important the back is in our body.

In two respects its importance is obvious: for *beauty* of body and bodily *health*.

The *beauty* of the body, its plastic form, is first of all due to the spine and its muscles, both in rest and in movement.

It is at once evident that the carriage of the body, its architecture, are fully dependent on the spine. A freely poised head, a beautiful neck, an arched chest, well-placed shoulders and a slim waist are always associated with a well-developed spine and well-developed muscles of the back.

The *movements* of the body are just as dependent on the spine as its carriage. The movements cannot be easy, free, natural and plastic without the back being both supple and strong. A good spine follows and adjusts itself easily and surely to all the different positions which the movements of the body demand, from the smallest movements to the biggest. When one worker has an easy and handy way of doing his work, and another has a heavy and clumsy way, the difference is due in no small degree to the supple back of the first and the stiff back of the second.

Upon such an everyday movement as walking, the influence of the back is evident. The pelvis sways up and down as it rests on the right leg in one step and upon the left in the following step. In response to this swaying a small wave-like motion proceeds up through the spine, but only if it is well developed and supple, and then the gait is easy and agile. When, however, the back has lost its natural mobility, it does not answer to the swaying of the pelvis as it should, and then the gait is heavy, rocking and marked by age, even though the individual may be as young as twenty. Not only one's walking, but one's physical behaviour and appearance are given the stamp of old age when the back is stiff, quite regardless of one's real age ; indeed, even children with stiff backs may in their movements remind us of old people.

For beauty of body, both in posture and movement, it is evident that a well-developed back is the first and most essential condition.

Further, it is equally certain that the back is also responsible for important influences on certain aspects of the *health* of the body.

The two big cavities of the trunk, the *Thorax* and the *Abdomen*, are to a certain degree dependent on the spine ; thus the spine has an influence upon the organs which these cavities contain.

As far as *the thorax* is concerned it is easy to understand. The spine determines the position of the ribs. If the former is "straight" the ribs will be well raised, and the thorax will possess the beautiful form which is characterised by the word "arched," and which corresponds to the descriptive name which the Greeks gave the chest, *Stethos*, that which projects. The thorax is then capacious. If, on the other hand, the back is crooked, the ribs will be lowered so that the thorax becomes flattened from front to back and narrower from side to side; consequently it becomes less roomy. A flat and narrow thorax is, to doctors in sanatoriums, one of the signs of weak lungs.

Thus the spine influences both the shape and the volume of the thorax; and in no less degree it has an influence on the mobility of the thoracic walls, that is, upon the mobility of the thorax. The latter not only depends on the movements of the ribs upon the vertebræ, but also on the mobility of the spine itself, as the ribs have to follow the spine—if this is bent, the ribs are lowered, if the spine is stretched, the ribs are raised. And the more the ribs can be raised and lowered, the greater the inspiration and expiration will be. A capable thorax can change the capacity so much that after deepest expiration it only contains 1–1½ litres of air and after deepest inspiration 4–6 litres of air, according to the size of the person. On the other hand, if the back is round and stiff, the thorax will have lost some of its mobility, and it cannot effect such a change of capacity; neither inspiration nor expiration will be so great. By this the lungs suffer both in function and in nutrition. They do not get the alternative distension and contraction which deep inspiration and expiration will give the lungs, an action which promotes the circulation of blood through them; this applies both to the blood from the pulmonary circulation that is going to be "cleaned" and oxygenised, and the blood from the general circulation, which has to nourish the lung tissue and keep it healthy.

The lungs of a growing individual, if situated in a small and stiff thorax, have not the same possibility for developing normally, nor the capacity to resist disease, as have lungs which are in a roomy and mobile thorax.

The points (apices) are perhaps the parts of the lungs which are most easily influenced in an undesirable way by a round back. If the posture muscles of the back which have to keep the head erect are poorly developed, not only will the head and neck fall forward, but the 4 or 5 upper thoracic vertebræ also, and with the latter will follow the ribs attached to them—

especially the two upper ribs which can droop so much that they may press a deep furrow into the points of the lungs and damage the tissue. The upper part of the thorax will lose mobility, and the airing and circulation of blood in the points of the lungs will be restrained ; the function of these parts will decrease ; their nutrition will suffer ; they will weaken, and be easily attacked by disease.

Thus there is no doubt that the condition of the back influences the organs of the thorax, and there is just as little doubt about its influence upon the organs of the abdomen. The *abdomen* cannot change its capacity like the thorax ; at any rate not to the same degree. The organs of the abdomen are filled with blood and the food which is changed into a liquid, and liquids cannot be compressed by the pressure referred to. On the other hand, the abdomen can change its form ; it can either be long and narrow or short and broad. It is made relatively long and narrow by a straight back, and short and broad by a bent back. When the back is rounded the thorax is lowered on to the abdomen, the organs of which are pressed downwards. Thereby the abdomen becomes shorter. But if it decreases in length it has to increase in thickness, as the capacity is unalterable.

When the back is kept straight the upper part of the trunk is carried entirely by the spine and its muscles ; but when the back is rounded some of the weight of the upper part of the trunk is thrown upon the abdominal viscera. The pressure which is exerted upon them will restrain their function, and, though the pressure is small, when continually exerted it will be harmful. When office workers suffer from digestive troubles these are often due to sitting with a round back. After a big meal it is uncomfortable to sit bent forward, instead of sitting or standing with a straight back, because the abdominal organs are under no abnormal pressure when the back is straight. The old Romans understood this ; they formed the well-known rule : *Post coenam stabis seu mille passus meabis* (after the meal you must stand, or walk a thousand steps).

It is also important for abdominal welfare that the back be kept mobile. If the back is stiff, the viscera lack stimulation for their functioning which bending and turning movements of the trunk, especially in the lumbar region and the lower dorsal vertebræ, provide.

Still another fact has to be mentioned—possibly the most important. It is the influence of the back upon the passage of the venous blood from the abdomen into the thorax, where the heart's propelling power to this blood is exhausted so that the blood has to be sucked into the thorax. By the position which ribs and diaphragm acquire when the back is kept straight, both diaphragmatic and costal breathing take place more easily, and then more vigorous suction is exerted upon the blood passing from the abdomen to the thorax. On the other hand, when the upper part of the trunk is bent forward and presses on the abdomen, the breathing movements of the diaphragm and the ribs are restrained, and the suction action upon the blood decreases so that the blood circulation is impeded at the most difficult point.

If the value of a straight back is to be appreciated, facts such as those mentioned will have to be considered, for a straight back concerns more than beauty. *The straight back benefits health by promoting the development and function of vital organs.*

Assuming a well-developed back to be a great benefit, *how can this benefit be obtained*, and *which factors are decisive?*

The most important factors are *the parents* (*especially the mother*), *the school* and *the individual himself.*

The Parents

The mother[1] *is incomparably the most important* with regard to the first years. The mother, and she alone, provides the foundation of the young life. She needs to consider her child's back before it is born. Her condition of health and the food she eats are very important for the development of the expected child, also for the development of its back.

Many of the sufferings which develop in a child during infancy and early years, such as rickets, weak back, bad teeth and anæmia, can often be traced to an unhealthy condition of the mother and to her deficient nutrition during pregnancy, for her food is also the food of her unborn child.

Her food therefore must contain everything which a growing body needs for normal development. If the food is insufficient

[1] The following concerning pregnancy and infants is taken from the writings of the Norwegian specialist, Dr. med. Fru Kirsten Utheim Toverud, particularly from her articles in "Norsk Magasin for Lægevidenskap," 1929 (p. 1245), 1930 (pp. 53 and 286), and 1931 (p. 677).

or unvaried, both she and the child will suffer, and this, too, is detrimental to the skeleton of the child, of which the spine is a particularly vulnerable part.

Mother and child are as one organism, not only *before the birth*, but even *after birth*, as long as the child lives solely on the mother's milk.

The food on which the mother should live during pregnancy and the lactation period is, fortunately, simple fare, neither difficult nor expensive to obtain. It is the quite normal, plain food, which everybody ought to live on. This is mainly wholemeal bread (*i.e.*, bread containing the whole nucleus of wheat or rye), milk and milk products such as butter and cheese, various vegetables, fruit and meat and fish.

When the preparation is not too elaborate and the cooking has not been too vigorous and long, such food contains the substances, particularly certain salts and vitamins, which the bones of the child need for their foundation and structure.

If the mother's food does not contain enough, say, of calcium for the bones in the embryo, Nature helps herself to a certain degree by exacting the deficiency from the mother. It protects the coming generation at the cost of the preceding one, causing the mother's bones to yield some of their calcium contents to the bones of the embryo. As the teeth also are bones, we find the explanation here of the old adage that a child costs the mother a tooth.

When the mother has nourished the pre-natal child well, and it is healthy at birth, there is a good foundation on which to build, by (1) proper nutrition through its mother's milk; (2) light and air; and (3) gymnastics, which for a while consists only of one exercise.

She must know that the bones of the new-born child are but slightly ossified; they are soft and may be easily deformed; this applies in a special degree to the bodies of the vertebræ, and it is important to remember this as their form determines posture.

The position which is especially liable to deform the vertebral bodies is *sitting*. Hence it is a mistake, which must be guarded against during the first year, to let the child sit up for long periods, *e.g.*, by propping it in a cot or perambulator with cushions, in a baby's chair, or by carrying it for a long time on one arm. Its back muscles are not strong enough to keep the body upright; it will sag forward with the back bent (Fig. 4).

In this position first of all the muscles suffer, both those which stretch the back, and those which bend it. The *back-extensors*, the only posture muscles of the body, are in a round back stretched beyond their normal length; gradually they adapt themselves in growth according to this position; they grow too long. Their antagonists, the *abdominal muscles*, also adapt themselves according to the bent position, which brings their origin and insertion nearer to each other; they grow too short and thereby hinder the stretching of the back. By such adjustment in these two sets of muscles the foundation of a permanent round back is laid.

FIG. 4[1].—The back of a four months old child in sitting position.

As long as only the muscles have adapted themselves, the posture defect is comparatively easy to correct in the little child. It is worse when the ligaments of the back also start to adapt their length to the bent position, so that those on the back of the spine become longer, and those in front shorter. Ligaments are more difficult to deal with than muscles.

But it is worst of all when the vertebræ alter their shape too, and the younger the child is, the easier does this take place.

In the infant the bones largely consist of gristly tissue: they are soft. The bodies of the vertebræ are not firm enough to carry the weight of the upper trunk of head, shoulders, arms and chest, when the child is sitting, and in this position its back will inevitably be crooked. In this bent position the weight of the upper trunk rests mostly on the front edges of the vertebræ particularly on the front edges of those at the climax of the curve, the lowest 4 or 5 thoracic vertebræ; they yield and are pressed wedge-shaped, so that they are shorter in front than behind. A spine which is built up of wedge-shaped vertebræ cannot help being crooked; and it is permanently crooked; for wedge-shaped vertebræ can rarely be re-formed again, especially as the damage is not discovered until ossification is far advanced.

[1] Figs. 4, 5 and 7 from Professor Hans Spitzy's "Die körperliche Erziehung des Kindes." By special permission.

Too early adoption of the sitting position is without doubt one of the most important reasons for the very frequent form of round back limited to the lowest thoracic vertebræ, which are pushed backward in the sitting position (see Fig. 4, p. 81). The rounding may be so limited that it only involves a couple of vertebræ, or it may include four or five. This form of round back is easy to distinguish from the ordinary round back; in the stretch-standing position it is seen as a distinctly localised backward curve. Above this the back is generally straight enough; below it often produces a fixed lordosis, which appears as a flat, or sometimes a concave section of the loin when the back is bent forward (Fig. 27).

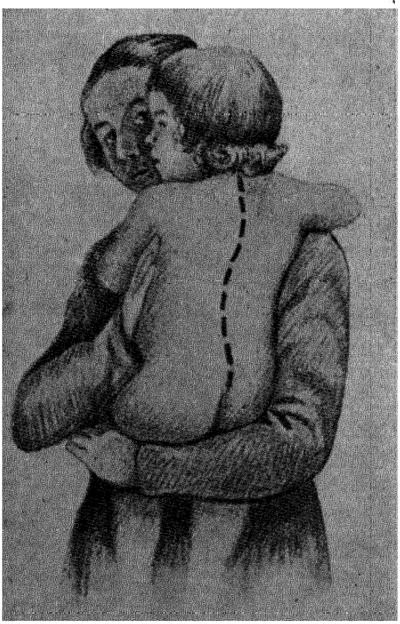


FIG. 5.—Carried on the arm the child's back will get an oblique position.

When the mother is in the habit of walking with the child on her arm—usually the left in order to have the right free for work—the sitting position not only becomes bent but also wry, and so the vertebræ involved may then become wedge-shaped from side to side. To the beginning of kyphosis is then added a beginning of scoliosis (Fig. 5).

The child must spend most of the time of its first 6-7 months lying on the back on a flat, not too soft, but sufficiently warm mattress with a very thin pillow under the head. But from the first or second month it ought often to be turned on to its stomach.

In this "front-lying" position the child will try to raise its head. At first the upper back extensor muscles tremble, for they have to lift the big, heavy head, yet are not strong and the head soon drops. But the child repeats the experiment, and it does not take many weeks before a healthy child has trained these muscles to keep its head raised for increasing periods (Fig. 6). The child acts instinctively in furthering its development, and this position is more and more favoured.

This "*front-lying*" is the first gymnastic exercise which the mother ought to give her child. It exercises important muscles, the principal posture muscles which pass from the middle of the back, *i.e.*, from 5th–6th thoracic vertebræ, upward to the cervical vertebræ and the back of the head (*e.g.*, the splenius muscles). When these upper back-extensors are well developed they provide free and easy carriage of the head. By this the upper part of the back acquires correct adjustment, and to effect balance the lower part of the back must then adapt itself properly.

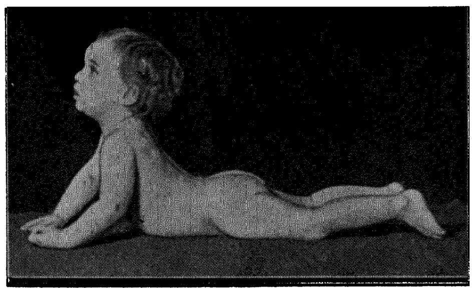


FIG. 6.—A child used to "front-lying" from its second month has strong neck and back muscles.

This front-lying is most important, as it alone gives the foundation for fine posture and a well-shaped body.

When the child is 6–7 months old the next basic exercise starts—one also very important for the child's development. It is *crawling*. Crawling is walking on "all fours," and it is the best, the most effective, preparation for walking erect.

A 6–7 months old child lying on the stomach may look about and discover something it would like to get. It places elbows and knees against the surface on which it is lying and tries to push itself forward to the desired object; thereby, little by little, it gets up into a crawling position on knees and hands (Fig. 7). This position is most favourable for the back of the child during the second half of its first year. The back is kept almost horizontal, both the legs and the arms being kept well underneath. There is no deforming load imposed by the upper trunk upon the vertebræ, and the back extensor muscles are not stretched out as when sitting with rounded back. The child walks on all fours—as the four-footed animals do in walking—moving opposite arms and legs, left arm and right leg in one step, right arm and left leg in the next. During this action an S-shaped wavelike motion proceeds throughout the back. It demands work of the back extensors and develops them. The bones involved, forming the spine to which the muscles are attached, are also developed ; the nutrition of the vertebræ improves, their ossification is promoted, and they become more capable of resistance to deformity.

The upper back extensor muscles, the chief posture muscles, get similar work when carrying the head during crawling as during front-lying ; thus crawling is an excellent exercise for these muscles.

FIG. 7.—First attempts at crawling.

Parents ought to allow their children to crawl as much and as long as they like. They must give them good opportunity for it, without danger of infection from dust and without exposure to cold. A crawling-pen ought to form part of the nursery. It provides an excellent place for exercise—a complete gymnasium for the child. In this the child by itself works out the natural exercises which it needs for development of both trunk and limbs.

Hence crawling is the best means whereby the little child of 6–12 months may develop the spine and its muscles. It prevents the formation of abnormal spinal curves, and counteracts any deformity which may have begun in the child's first months, *e.g.*, sitting kyphosis (see Fig. 4, p. 81).

When the child, at about 1 year, has developed a sufficiently firm and strong back through front-lying and crawling, it starts to raise itself on to the feet. Parents ought to let the child determine the appropriate time. *It is a mistake to help the child to stand too early.* Deformity of the spine and of the bones of the legs (bandy-legs) may be produced by this. When the muscles and bones are sufficiently developed, the child does not hesitate to make use of its powers. Driven by the irresistibility of Nature, it raises itself up and solves the difficult problem of bringing the back from the horizontal, supported on four points, to the vertical, supported on two. It needs much practice to get the long mobile spine balanced above the legs. With the first successful attempts, both astonishment and delight are to be read in the child's face.

The next 5 or 6 years are favourable for bodily development and for the spine, but only if the child is allowed to satisfy its extraordinarily strong, indeed almost indomitable, desire for movement, and if it gets food containing all necessary substances and vitamins. If it has an opportunity for moving about as it likes, both indoors and outdoors, it is sure to give its back much developing, bending and turning. The big head, which has to be balanced on top of the spine, forces the child to keep the back straight, just as may be observed in people who habitually carry burdens on their heads.

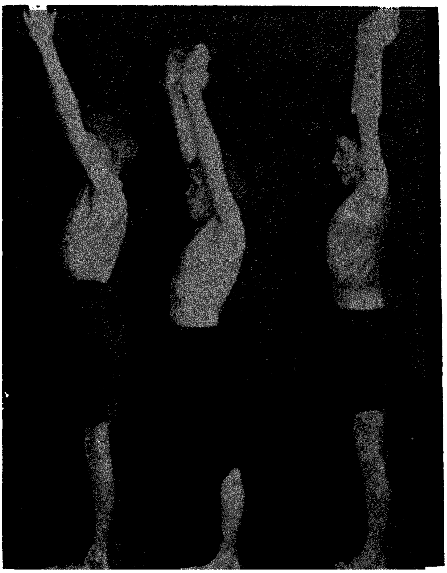
With schooldays a change takes place. The community encroaches upon the child's life by demanding compulsory education and requires the child to sit at a school desk for several hours daily through many years of growth.

Even if the sitting position is not quite as harmful for the back during these years as during the first year, it is still a very undesirable position for the growing body, particularly during the period of vigorous growth which starts in the 6th–7th year, when the exchange of milk teeth for permanent teeth begins. The child is forced to keep quiet, its desire for movement is dulled, its back is bent, and it acquires the habit of keeping the spine bent in standing also. Then, if it also sits cramped at home over its lessons, at music, at sewing, etc., and if it lies bent during the night with bolster and pillow under the head, the back grows crooked just as surely as a branch grows crooked if it is tied into a bent position.

The sitting position is necessary. Civilised man needs knowledge in order to get on in the world. The appropriation of special knowledge must often take place while sitting. But parents and teachers must never forget that this position restrains bodily development. Energetic measures should be undertaken to counteract it.

First of all it must be demanded that parents send their children to school with backs unmarked by preventable defect, not to say deformity. There is reason to emphasise this strongly. Not 50 per cent of the children of 6–7 years of age have faultless backs. With the relatively few physical training lessons which the school provides for 6–7-year-old children—sometimes only one or two per week, perhaps none at all—these defects cannot be remedied, particularly as during the other lessons the sitting position aggravates the faults.

What then can be reasonably demanded of the parents during the child's first 6–7 years?



a b c

FIG. 8.—The boys *a* and *b* suffer from round and stiff back and cannot raise their arms to the proper stretch position. In *c* it will be seen that a good stretch position lifts the chest and gives a slender appearance.

It has already been emphasised that responsibility for the child's back in the first year lies with the mother. She must see that it gets good mother's milk and plenty of front-lying and crawling. The foundation she lays is of decisive importance for its whole life. During the pre-school years the parents must provide the child with opportunity for *maintaining normal mobility*.

Stiffness threatens the child early, and *stiffness of the back is the beginning of spinal deformity*.

In each of the numerous joints of the back there is normally only a small degree of mobility, and just because it is so small it is easily lost. No joints in the body are treated so carelessly by civilised man as the joints of the back.

The simplest means whereby parents may discover the beginning of stiffness in the backs of children is through the *stretch position* (Standing. Arms upward). In this position the arms ought to be stretched so high and straight that they form an angle with the body of 170–180 degrees (Fig. 8, *c*). If the angle is only 140–150 degrees it indicates the beginning of stiffness in the back (Fig. 8, *a*, *b*). There are only a few exceptions to this rule.

If a child cannot raise the arms higher in stretch position than shown in Fig. 8, *a*, *b*, it is easy to see that it needs to practise hanging by the arms. The weight of the body will then straighten the shoulder angle, and because of the connection of the ribs with the dorsal spine the latter becomes stretched out, whereby its mobility is maintained or encouraged. By the upward pull on the ribs exerted by the chest muscles in the hanging position, the thorax is kept mobile. A mobile thorax is one of the conditions for the full development and functioning of the lungs (pp. 77, 78). As long as the child cannot hang by itself from some suitable apparatus, the father may grasp its hands and wrists and lift it up into the hanging position. When it has grown big enough, at about 4 years, he can often let it hang from his neck, as shown in Fig. 112, p. 223. This is a particularly effective exercise for stiff shoulders, and stiff back and thorax.

Amongst the things which the parents should provide for their children, to give them an opportunity for useful bodily exercise, are a section of wall bars and a beam or bar, which are best placed in the bedroom. With these the children practise and exercise and gain much development, and they will devise exercises even if they receive no help.

The School

Thus when the parents have taken care that the children have developed normally during the first 6–7 years, and that there is neither stiffness nor rounding of the back or scoliosis, the young pupils are easy for the school to train. It should take the responsibility of seeing that school life is not injurious. Indeed, it should not even restrain the children's bodily development; the school must accept as its duty the task of promoting bodily development, just as obviously as it sets out to promote mental development. We must get to that point where the school has a positive influence on the health of the children; it has too long and too often had a negative one, particularly in the upper schools, which the children attend through the period of puberty, the last stage of growth for the body. Defects and deformities acquired during this period persist throughout life. The whole body, even the bones, are then plastic and mouldable, and can be greatly influenced by external factors. The position which it takes most often and long becomes its *habitual position*, a position which it maintains whether resting or working. This applies to youth in both sedentary and manual occupations, as the bad working position or malposture is generally the same: crooked back, shoulders drawn forward, head poking forward. The body, and especially the central part of the skeleton, the spine, grows and takes shape according to the habitual position.

What has the school to do in order to solve the problem of guiding the growth and development of the child's body?

First of all it must not be niggardly with time for physical training. Two or three lessons a week are too few. There must be a daily lesson.

Next, good external conditions for physical training must be provided: a clean, light and airy gymnasium with baths; a good games ground preferably adjoining the school; and, wherever practicable, facilities for swimming.

Third—and the most important—it must demand teachers who have sufficient knowledge of the structure of the growing body and who know the requirements for its normal development, who have a good practical and theoretical training in the different branches of physical education, and who have teaching ability.

Fourth, the school must impress on teachers, whatever the subject they teach, that they all have a certain responsibility for the bodily development of the children. Bodily growth and development are proceeding whilst the children sit at their desks.

Last, the school must cultivate the parents' active interest in the bodily development of their children and not in mental development alone. Parental indifference discourages both children and teachers.

Where these points are satisfactorily met, obviously good results from the physical training at school are gained, and the backs of the children will develop normally.

Concerning the back, the teacher must remember that the first essential is that mobility be preserved in all its many joints.

The part of the spine which suffers most often and earliest from decreased mobility is the dorsal spine. It is this part which is bent and stiffened by a poor habitual or working position.

The commonest working position of the school child is sitting. The harmful influence of a bad sitting posture must be counteracted. The teacher must patiently and frequently remind the children about stretching up. Now and then he may tell them that a bad sitting position (Fig. 9) gives a round back and an ugly body, and hurts such important organs as those of breathing and digestion.

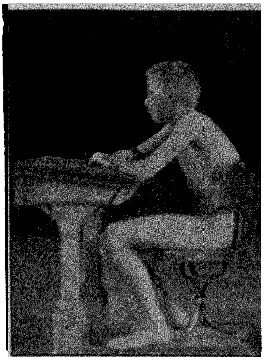


FIG. 9.—This posture with rounded back is common in children while sitting at their school desks. It is the beginning of many a permanent round back.

But these appeals must be supported by action. At the end of the lesson let the children sit well back against the back support of the desk and then bend backward, trying to touch the desk behind with the head (Fig. 10). The arms may be kept down by the side at first, but when the children are trained they can do the exercise with upstretched arms, and the useful effect is increased.

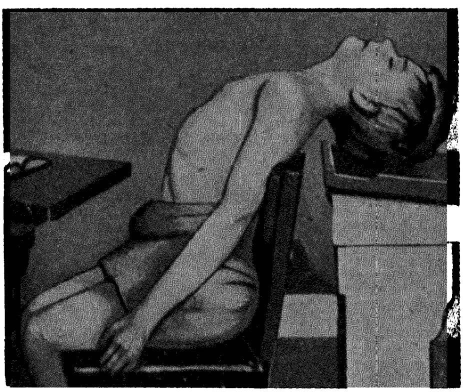


FIG. 10.—Trunk bending backward over the back of the form is a very effective correcting exercise to the round-backed sitting position adopted at school and elsewhere.

What makes this exercise specially suitable for counteracting stiffness in the dorsal spine is that the back gets a firm support just in the right spot, at the climax of the curve of the dorsal spine. Thereby the latter is forced to stretch much more vigorously than in a free-standing trunk bending backwards. Mobilisation of the spine and the maintenance of its flexibility produce a like effect on the thorax, particularly in its upper part which encloses the apices of the lungs (p. 77).

If during the lesson the teacher feels that the children are getting dull and inattentive, it is enlivening for them to do this exercise a couple of times. Their pent-up need of movement is released, they again become receptive of the teaching. Three such trunk bendings backward take about 10 seconds. This is not much time to sacrifice to the body when the brain gets the remainder of the lesson time.

Furthermore, sitting trunk bending backward is an exercise which is useful for the children to practise so that they do it habitually at home, for instance, when they have been sitting for a time over home-lessons ; indeed, use it eventually throughout adult life whenever they have sitting work. This habit is not difficult to acquire, especially as the exercise is felt to be beneficial.

Good though even this little, easily performed exercise is, other exercises must also be used.

The many joints of the back act together as a ball-joint. Therefore the back can move in all possible directions. One might think that, correspondingly, many exercises would be necessary to keep all the joints mobile. But the matter is more simple. If the back can move in the 3 main directions—forward-backward, from side to side, and twisting about its long axis—then it can also move in all intermediate directions.

The exercises which move the back in these 3 directions are the 3 well-known trunk exercises : *trunk bending forward and backward : trunk bending sideways : trunk twisting.*

They form the core of Ling's posture-promoting gymnastics, and they ought to be largely used in developing and forming the back.

Ten trunk bendings forward and backward, 10 trunk bendings sideways and 10 trunk twistings, 30 movements in all, take 35–40 seconds only when done in fairly slow rhythm, so that every movement is carried to its fullest possible range. Little more than half a minute is required every day for doing these exercises which contribute so well to the development of the back of the child, while adults will find in them an effective means of preserving fitness of the body which is often too early marked by age.

In every gymnastic lessons these 3 fundamental exercises ought always to be taken in a simple and effective form apart from the practice of other trunk exercises. Further, they should certainly find place in every lesson of classroom gymnastics, however short it may be. They ought to be practised both for the sake of the immediate effect and for the ultimate effect obtained by the children acquiring the

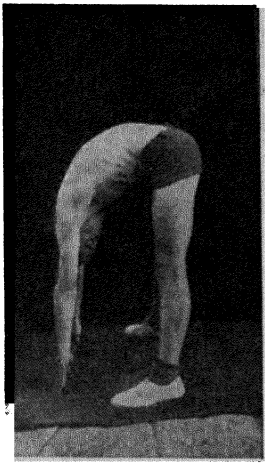


FIG. 11.—Trunk bending downward.

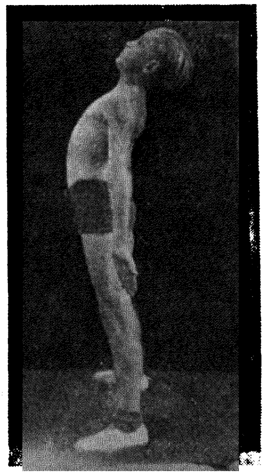


FIG. 12.—Trunk bending backward.

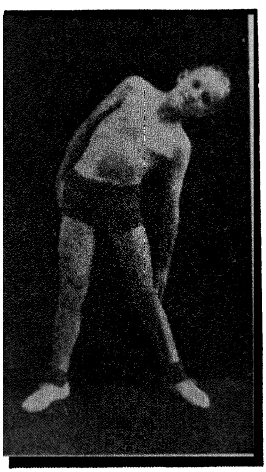


FIG. 13.—Trunk bending sideways.

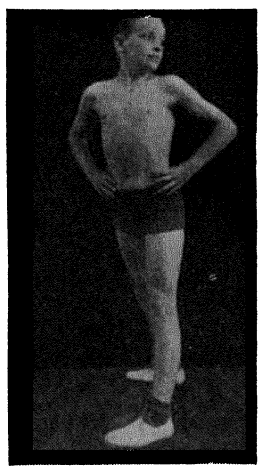


FIG. 14.—Trunk twisting.

habitual practice and knowledge of the exercises for use when schooldays are over. When the children get to know the aim of the exercises and feel the well-being which follows them, they do not mind the repetition of the exercises any more than they do of other frequent or daily procedures, such as washing and cleaning teeth, etc.

All *front-lying* exercises, it must be emphasised, are effective exercises for the back. It has been mentioned that front-lying ought to be the first gymnastic exercise for the infant (p. 83). It continues to be one of the most important exercises for developing the back-extensors, not only during schooldays, but throughout life.

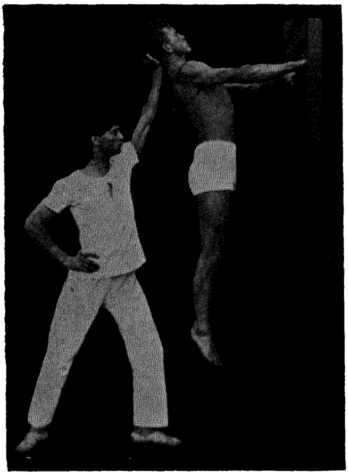


FIG. 15.—Head support hanging.

Head support hanging is an effective exercise for strengthening the upper back-extensors, the most important of all posture muscles, which run from the middle of the dorsal spine to the neck and head. As may be seen from Fig. 15, the body is carried by these muscles during this exercise. Here they get work which corresponds to their strength, and it therefore develops them and gives them the right length for a proper carriage of the head.

The teacher must make his pupils understand the importance of acquiring a good *stretch position* to benefit the back (Fig. 8, *c*), by showing them the stretching effect the exercise has on the back and the degree to which it raises the thorax and increases the upward mobility of the ribs. (Fig. 77).

The teacher has a good means of correcting a bad stretch position through all forms of hanging positions and hanging exercises: Arm walking with straight arms; swinging with straight arms on the beam, ropes, etc. But he has the best help in *span-bending*, both passive and active forms. The strong backward pull of the upstretched arms benefits particularly the upper part of the thorax and back and maintains mobility.

When the children see how nicely a good stretch position forms and builds up the whole body, they will be keen to be able to take this position freely and easily (*i.e.*, without strain).

The Individual

As with bodily education so with mental—real success calls for desire to succeed, volitional power must be exerted, the will must be there.

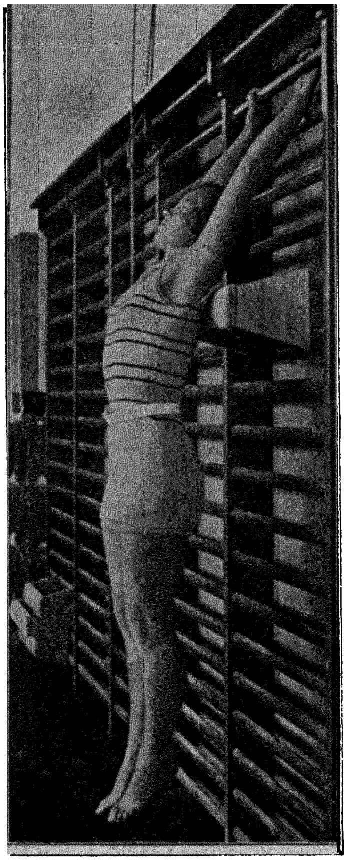


FIG. 16.—Passive span bending with span stool. Good stretch position ; arms in line with the trunk ; chest raised ; no hollow back.

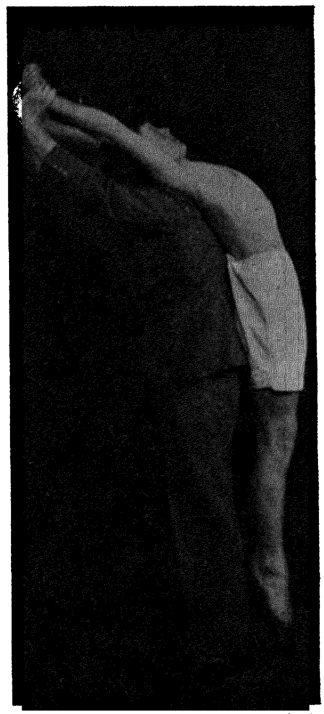


FIG. 17.—Passive span bending with help.

If you have made up your mind that you are going to have a strong, beautiful and supple back, it is not enough that you place all your reliance on the few gymnastic lessons weekly in school; you must also work with your back outside these school practices, especially as they are usually fewer in the summer months.

First of all you must pay attention to your habitual position. It must be good. If it is bad, the same thing will certainly happen to your back as to a plant which is kept bent; it will grow crooked. You must stretch up when you are walking. At first you will have to *think* of it. Your posture will then appear somewhat stiff and affected, but after a time you will keep yourself straight without having to think about it. Then it has become natural to you; you will feel easy in it, and it will no longer look stiff and affected but attractive and natural. Having obtained a good habitual position, your body will grow and shape itself properly until it is full grown.

In order that you may adopt a satisfactory habitual position easily when not working, and an efficient position when sitting or standing at work, you must possess *a back without stiffness and with good muscles.*

The three trunk exercises will keep your back supple. Do them daily. They affect the lumbar spine, however, more than the dorsal spine. If you have some stiffness in the dorsal spine, originating from your first infant years, you need exercises which affect particularly that part of the spine.

To regain its mobility there is probably no better exercise than passive span-bending (or span-hanging). It needs wall bars and a "span stool." You should ask for the apparatus when your parents are considering giving you a present. It is not expensive, and the wall bar gives you an opportunity for many other fine exercises. Look at the spanning position in Fig. 16. Notice how the back is stretched, the chest lifted, that the arms have come into the right position to the slim body, and that the shoulder angle is near the ideal, 180 degrees. Until you get wall bars, your father can take you on his shoulders (Fig. 17).

If you have wall bars you should do an active span-bending after the passive one.

The passive span-bending, as the name indicates, is one in which the dorsal spine is made supple and the front chest muscles are stretched, without the muscles, which could attempt to do this, working. Thus these latter muscles, the back-extensors or posture muscles, which maintain good carriage in a supple back, are not developed by this passive form of exercise. But they are developed by *front-lying* (Fig. 18), which you can do lying on a stool with your feet between the wall bars. You may also practise the exercise lying on the floor with the feet underneath a chest of drawers or something heavy, or in your bed by turning on to your front before you get up in the morning.

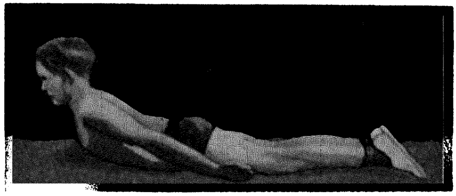


Fig. 18.—Front-lying.

Instinct, which is sometimes better than acquired knowledge, impels the little child to exercise its back-extensors vigorously. By pressing the head and neck backward and stretching the back, it shows signs of bodily well-being. When lying on the back it may stretch itself so strongly as to lift itself up into an arch, supported only by the back of the head and the feet. The back-extensors work very hard in this, especially that part which passes to the back of the head and neck; they are largely responsible for making the arch. You could do this exercise when you were about 1 year old. Try if you can do it now. It is most easy to do in bed. Place the hands under the neck, bend the knees a little, feet apart. Press the neck and elbows so hard backward that you lift the shoulders, and then push the body up into an arch without yielding in the neck (Fig. 19). If you fail to keep the neck stiff, but sag on to the shoulders, the exercise will impair rather than improve posture. Done in the right way it is an excellent posture exercise.

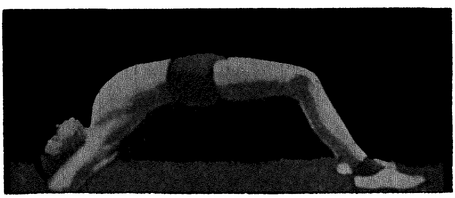


Fig. 19.—Neck span. The extensor muscles of the neck, most important concerning the carriage of the head, work strongly.

There is another "exercise" by which you can develop the upper back-extensors, the posture muscles of the head and the neck. It is lying on the front while reading (Fig. 20). Support yourself on the elbows and lift your head so high that the eyes are at the correct reading distance from the book. In this position the posture muscles have to keep lifted the relatively heavy head, and the back takes up a position opposite in effect to that when you read in a sitting position—very stretched instead of bent. At first you get tired in the neck, but the muscles get so trained that soon you will be able to read for half an hour or so without getting tired.

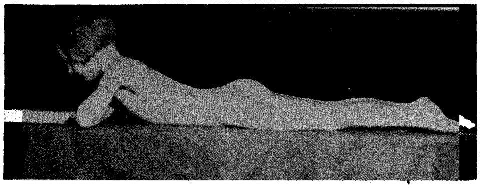


FIG. 20.—Good position for reading.

You must also do trunk bending backward as over the back-support of the school desk (see Fig. 10, p. 89) at home now and again when you sit working. Notice how beneficial it is. You will soon get so keen about it that you will not forget to practise it. Keep doing it regularly throughout life; it is just as good for an adult as for a child.

There is a further "exercise" which you often do without realising how valuable it is. You "stretch" yourself (Fig. 21), for instance, after you have been sleeping, especially if you have been lying bent with a high pillow under the head. The term is significant—you straighten the crooked back. You may even feel a "snick" in the back. The joints of the somewhat stiff dorsal spine seem to crack when they are forced to move in producing the stretching. Your instinct makes you stretch the back just in the right place, much better than when you are doing the corresponding exercise to command in the gymnasium. The need for "stretching oneself" in the mornings is a hint that round back is not natural.

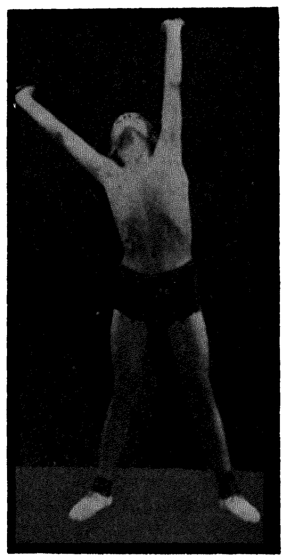


FIG. 21. — "Stretching oneself." A powerful stretching of the dorsal spine.

When you need a rest, a short nap, then lie flat on the back, say, on the floor. Then note when you wake up how much better and free you feel in the chest. This is due to the stretching of the dorsal spine and the consequent lifting of the thorax.

Do not accustom yourself to lying with a bolster or high pillow under the head. Use only a thin pillow, which should be placed between the head and shoulders when you wish for a change to lie on the side. Many cases of round back have been partly self-corrected by the discarding of high pillows.

Notice if it is easy and comfortable for you to be flat on your back. If it is unpleasant and uncomfortable it indicates that you are getting a round and stiff back. Look at the two X-ray photographs of a straight and a round back (Figs. 33 and 34, p. 112). The head of the boy in Fig. 88, p. 202) touches the surface when he is lying on his back, but the boy in Fig. 31, p. 110) must bend his neck far backward in order to reach the surface, and that position is felt to be uncomfortable.

Also consider your loin when you are lying on your back on the floor. If your back is straight as in Fig. 33, the loin will be so close to the floor that you can only place a flat hand underneath. But Fig. 34, on the contrary, shows that a clenched hand could be placed under the loin; this indicates that the loin is too "hollow"; the hollowing is a compensation curvature to the round back curve.[1]

You can use the back-lying position throughout life to test if the back is straight and supple, or if it is getting bent and stiff.

Parents and especially teachers (both men and women) must learn to judge a back.

If the children's backs are to develop normally they must be watched regularly. The earlier the deformities of the back are detected, the more easily they may be corrected.

School doctors, if they carefully examine the backs of the pupils, can greatly benefit the rising generation. But even where schools are attended by school doctors it is still necessary for parents and teachers to know how to examine a back; it is their duty to see that the back develops in the right way, and that any sign of defects is corrected at an early stage.

It is easier than people may think to judge a back. At examination of backs in schools, time after time it has been proved that parents and teachers can quickly learn to see if a back is sound or has defects, especially when they get three or four backs side by side for comparison.

[1] If older people feel blood rush to the head when they try to lie quite flat on the back, they must abstain from so lying.

The individual whose back is to be examined must have the upper trunk naked and stand with the back towards the light, so that no shadows fall upon it. Then the arms have to be stretched up and carried well backwards in stretch position.

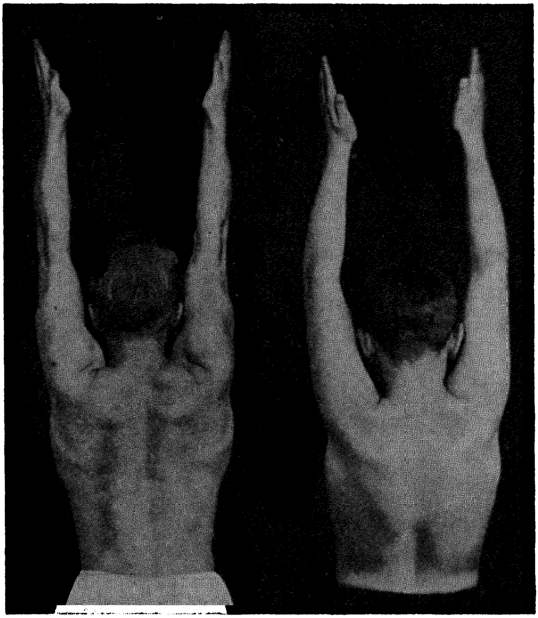


FIG. 22.—Good stretch position showing a distinct furrow down the back. The dorsal spine is mobile and able to be stretched, and the extensors of the back are well developed (A-back).

Fig. 23.—Stretch position showing a back where the whole dorsal region is rounded; the deformity probably acquired during adolescence because of bad habitual posture or too hard physical work; no furrow between neck and loin (D-back).

In this position the pectoralis major and minor muscles, which run from the ribs to the arm and shoulder-blade, will be pulled out as far as their elasticity permits; after that they act as taut bands which pull on the ribs. The more mobile the ribs are the more they will be lifted, and the higher the arms can be carried in stretch position.

It depends, however, not only on the mobility of the ribs at their spinal joints as to how far the elevation proceeds, but also on the mobility of that part of the spine to which the ribs are attached. The more this part, the thoracic spine, lacks its normal flexibility, and the more bent it is, the less will the ribs allow themselves to be lifted, and the less can the arms be lifted toward the stretch position—and vice versa.

FIG. 24.—A round and slightly stiff back. No furrow in the middle region. Most likely due to too prolonged sitting during very early infancy. (C-back).

FIG. 25.—A fairly good back but somewhat poorly developed. (B-back).

This close connection between the mobility of the spine and the arms makes the stretch position an excellent means for estimating the state of the back. If the arms are carried completely up to a good stretch position, and are so held in line with the trunk, the back will be stretched throughout its length; it will possess its normal flexibility. If the arms cannot take up this position, but are held obliquely forward, the back is crooked and stiff. This is a rule, though there are exceptions, but few.

When the back is straight and flexible, in the stretch position it shows a regular furrow down its centre, the furrow increasing evenly in depth from above downward (Figs. 22 and 25). On the contrary, if the back is bent and stiff in a greater or smaller region, the furrow will be proportionately shallow in this part, or even absent, and the curving of the back is thus obvious to anyone (Figs. 23 and 24).

When the arms are carried forward-upward to stretch position, they will stop rather suddenly and firmly when the

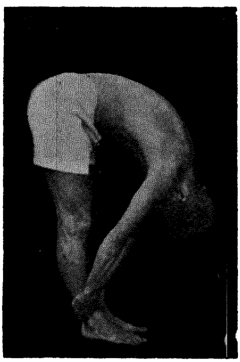


FIG. 26.—Stoop position showing an even curve of the back.

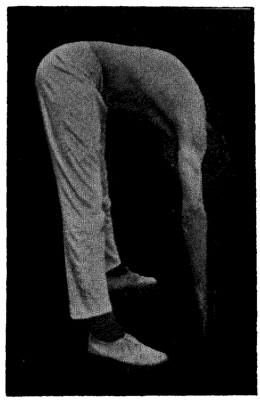


FIG. 27.—Stoop position showing a fixed lordosis.

back is stiff, as though there were an obstacle which the arms, in spite of effort, fail to surmount. It will be observed that the bent part of the spine is unaffected; it remains stiff and "wooden." When the back is normal the arms will stop softly when they arrive at a good stretch position. The back is involved in the movement; it is "alive."

A backward bending in the dorsal spine demands and evokes a compensatory forward bending in the lumbar region for the maintenance of balance. The loin, which is very flexible compared with the thoracic part, adapts itself to meet this requirement. When the backward bending in the thoracic region ("round back") has existed for a sufficient time and has become permanent, the opposite bending in the loin will also be permanent. This ("hollow back") fixes itself when the muscles and ligaments of that part shorten. Then the back is both "round backed" and "hollow backed." The same rule applies here as in lateral curvature, where a bending to one side induces a bending to the opposite side.

Whether hollow back has fixed itself or not is easily detected when the back is bent forward as much as possible. A normally flexible back in this position (stoop position) forms an even bending (Fig. 26). In a fixed hollow back this part of the back, the loin, will not bend; it remains straight, breaking the even bend of the back; indeed, it may stay concave (Fig. 27).

The vexed question of "*hollow back*" becomes more clear and easy to understand when it is seen that hollow back always is a necessary result of a round back. In the great majority of cases round back is the primary defect. A round back, especially the short form involving the 2 to 4 lower thoracic vertebræ, may have become fixed before the hollow back caused by it has had time to become so. Life calls for much more movement in the lumbar part of the spine than in the dorsal part. But the hollow back will at last fix itself if the round back is not or cannot be corrected.

Gymnastic teachers for a long time have been frightened by hollow back; there is good reason for this, as hollow back is a bad defect. But the alarm, particularly amongst women gymnasts, has been exaggerated and has led to the adoption of wrong counter-measures. Thus many thought that backward bending of the loin should be avoided: that the standing position should be practised with somewhat forward-upward tilted pelvis (diminished pelvic inclination), whereby the natural lumbar-curve is over-straightened. Some even implied that the back ought not to be kept straight during trunk leaning forward, but should be bent (flexed) a little. Thus trunk leaning forward, that excellent exercise for the training of a good working position, would result in the practise of a bad working position for both sitting and standing work and would promote round back. Furthermore, many exercises were practised in cross-, crook-, and long-sitting positions, whereby the loin was not only straightened, but even rounded. The result of the scare was that several got their backs too straight, particularly so in the lumbar region, which is ungraceful, unnatural and far from an ideal condition.

The fear of hollow back must be replaced by a fear of round back. First of all, round back has to be corrected. As soon as the latter is corrected, the cause of hollow back is removed, and it will be corrected simultaneously. Naturally it is wrong to work so one-sidedly that, while correcting round back and strengthening the back-extensors, the proper development of the abdominal muscles is partially neglected. Indeed, well-developed abdominal muscles are a necessity if hollow back is to be prevented. A normal back possesses a loin which can bend well both forward and backward; the shape and the position of the articular processes (joint structures) show clearly that this bending forward and backward is the most important movement in the lumbar region. Therefore, bending backward in the loin must not be omitted from practice.

It is one of the drawbacks of civilisation that the development of the body is neglected. In two respects it appears particularly glaring—the teeth and the back.

It is maintained that only one per cent of civilised people have all their teeth entirely free from the effects of dental decay; some authorities give an even smaller percentage. Bad teeth are a sure sign of deficient nourishment; the deficiency may have existed during a single period either before or after birth, or during all the years of growth. And even had the food contained all the necessary substances, the body may yet have been ill-affected if, say, the digestive organs have been unable to absorb and convert the food so that all the nutritive substances could be properly utilised.

It is much the same with the back as with the teeth.

A faultless back is almost as rare as a set of 32 faultless natural teeth in a single mouth.

The principal reason for this, perhaps, is the state of nourishment during both the pre-natal period and the years of growth. The more incorrect the composition of the food and the more defective the ability of the body for absorbing and converting it, the more soft and plastic will the vertebræ become—and their shapes determine completely the formation of the trunk, as has been mentioned. If to this is added premature and continuous sitting, bad habitual and working positions, and too little exercise—as is often the case—then it is not surprising that the most delicate part of the skeleton—the spine—suffers, and that only a minority have faultless normal backs with sufficiently firm, well-ossified vertebræ, with mobility in all the joints and with all the muscles strong and well-developed.

Concerning the teeth the danger is well-realised; their condition may determine greatly the health of the rising generation. In more and more places, the school helps the parents in improving and maintaining the teeth of their children by the appointment of school dentists and the establishment of dental clinics. This, however, is a costly proceeding.

It must be hoped, therefore, that as much eagerness will soon be shown by the community and the school for the care of the back, as has already been shown for the care of the teeth. The cost of the former would be comparatively small. All that is required is enlightenment—enlightenment of the parents, of the school, and of the invidual.

The back changes slowly from the normal to the sub-normal. Little by little, and imperceptibly, stiffness and deformity creep into the back. People get gradually accustomed to defects in the back so that they hardly perceive them as defects; they get so accustomed that they think that the back cannot be otherwise. If the alteration from mobility to stiffness, from a well-formed to a deformed back, came suddenly, it would be felt with the same intensity as when a mobile limb suddenly stiffens as in cramp.

A strong, supple and sound back is a benefit which youth has to acquire and the adult maintain for the sake of health, capacity for work and bodily beauty.

§ 12. The Erect Position and the Position of Ease

A. The Erect Position (i.e., Position of Attention)

The erect position must be natural and unstrained. The breathing must be free, the body must be drawn up to its full height by means of as much straightening out as possible in the cervical, thoracic, and lumbar curves of the spine. In this way the chest gets its natural form. The head must be held straight and well-lifted, without the chin protruding, the eyes looking straight forward, not towards the ground; the shoulders must be somewhat drawn back, lowered naturally, and at the same height; the arms hanging easily from the shoulders, stretched but not stiffened; the hands in continuation of the arms, with the slightly hollowed palms towards the thighs, fingers together; trunk straight from hips and leaning forward so far in the ankle-joints that the line of gravity falls a little more in front of the ankle-joints than usual; legs naturally stretched; heels together and on the same line; feet equally turned out; angle between feet about 45 degrees (Figs. 28 and 29).

With children in their first and second school year, most stress must be laid on stretching up; the children must try to make themselves as tall as possible. Hollow loin must be corrected from the very beginning.

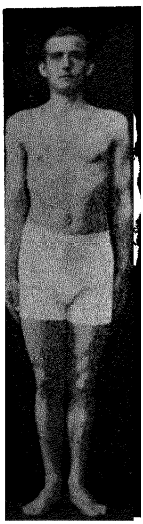


FIG. 28.

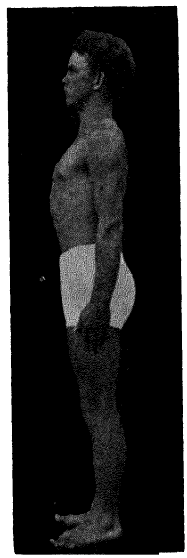


FIG. 29.

The Importance of the Erect Position. The erect position is the fundamental position in gymnastics. It is the first exercise; with it the gymnastic exercises begin. It has to be used at once before it has been properly learnt; and gradually as time goes on it will be acquired. It is the *starting position* of gymnastics but it may also be said, and more truly, to be the *final position*, for the aim of all gymnastic exercises is to make it perfect. The perfect erect position will not be acquired till the whole body is thoroughly trained and well developed. At any moment it forms the standard of how far one has reached in that direction.

The terms erect position and good carriage are sometimes used synonymously. But the good erect position is only one term for good carriage, namely good carriage in a certain gymnastic position. The term good carriage has a wider meaning. Good carriage shows itself in many other positions, and not in positions only but in movements too, both during gymnastics and in daily life. It is obvious that good carriage manifests itself in movements such as marching and running. But it may also be found in many other movements and positions, and it will leave its stamp on them. The one who possesses a good carriage has a different bearing under all conditions, at work or at rest, to the one with a poor carriage.

The question of carriage, and with that erect position, has been discussed keenly in the past and is still under discussion. It is considered a difficult and intricate question, but in reality it is very simple and clear as soon as one has understood that *it is on the spine the carriage depends.* The spine determines the carriage. "By carriage we understand the form and bearing of the spine," has been strikingly said by a Danish orthopædist. If its curves are too big or if there are other defects, and if the bearing of the spine is spoilt by stiffness, then the carriage will be correspondingly defective. If the spine with its muscles and joints is well developed and well trained, the carriage will be good; but if the muscles are poorly developed and trained in a one-sided manner the carriage will be poor. It is not lack of understanding of what to do that makes it difficult to obtain a good carriage; the difficulty lies in doing what one understands. Will-power is necessary to obtain a good carriage and still more to preserve it during life.

By a person's carriage, apart from whether it is good or bad, is meant that position which is taken by his body if left to itself when he stands unoccupied; it is, in other words, his habitual position, the position in which he feels most free and easy. As everyone can see, this position varies greatly in different individuals, as it is the result not only of inherited tendencies and build, but also of the use which the individual has made of his body and of the positions in which he has most often and longest kept it. It is not as a rule the most beautiful and healthy carriage which work and habit form. Most people, therefore, by degrees come to have a bad, or at any rate a less good, carriage.

It is especially the form of the spine—*i.e.*, the size of the various curves—which is the immediate cause of good or bad carriage.

During the first years of a child's life the curves of the spine are not fixed; they are almost entirely stretched out when it lies on its back on a flat surface, while they show distinctly in the standing position. By about the seventh or eighth year they are so fixed that they are always to be found, no matter what position the body is in. But they are not fixed so that they cannot become bigger; on the contrary, they are usually increased more or less beyond what must be considered the normal.

By an increase of the different curves beyond the normal the various forms of postural faults (and deformities) are developed.

Faults of posture (and deformities) are found partly in the *sagittal plane* (Latin, *sagitta*, an arrow) and partly in the *frontal plane* (Latin, *frons*, a forehead).

The most common faults of posture in the sagittal plane are *round back, kyphosis* (Greek, *kyphos*, curved), and *hollow back, lordosis* (Greek, *lordos*, inward curve of the back).

In the frontal plane *scoliosis* (Greek, *skolios*, oblique) is the most common postural fault.

It is the spine which gives the body form and beauty if well developed. It is the spine which makes it ugly and clumsy if badly developed or mis-shaped. It is on the dorsal spine that the form of the thorax and its mobility depend. It is the lumbar spine, normal conditions provided, which gives a slender or a thick waist and on it depends partly the greater or smaller inclination of the pelvis.

The importance of the back is not understood or appreciated as it ought to be. This lack of understanding and appreciation is met with first and foremost in people in general, and they pay for this lack of knowledge, often pretty heavily. But it is also found in many people in charge of physical education, resulting in harm to themselves and, what is worse, to their pupils. Lack of knowledge about a part of the body as fundamentally important as the spine, is a case for wonder. Here knowledge converted into action is necessary, as Socrates says.

Unlike arms and legs the spine lies well hidden. Firstly it is hidden by the clothing which covers up its defects and makes them unobserved. Secondly, the spine is situated in the middle of the trunk and therefore well hidden even if the clothing be removed. The supporting part of it, the column formed by the vertebral bodies, has an equal part of the trunk in front of it and behind it. The points of the spinal processes may be noted, but from them there is a good distance to the central parts of the vertebral bodies. The column itself must for the sake of balance be in the middle of the trunk, just as the tree trunk is centrally situated in the tree.

The back, with its many joints and muscles, a fine and ingenious mechanism, is very exposed to harm just because of its intricate construction. It is, more than any other part of the skeleton (the foot excepted), exposed to wear and tear throughout life. It is no wonder that extensive damage to the back may be caused gradually and imperceptibly if the back is badly taken care of, and very often such damage is not discovered till it is too late to mend it.

The back may be damaged in two ways. It may be put to *too hard use* either by being exposed to prolonged heavy work or to a momentary exertion such as a hard pull or a lifting of a heavy burden. This latter may often happen during growth. A young lad may wish to show his strength by carrying a burden or he may be egged on to do it, and his back may be damaged for life. This danger seems to be more understood in town than in country. A master may say to his apprentice, "Leave that burden alone, boy! it wants a man's strength." (Compare page 74). The back may also take harm by being *used too little*. Cases of this kind are met with mostly in adults and more commonly in townspeople than in country people. Townspeople that have no physical work, may sit year in and year out at the writing desk, in the office, at studies, at a sewing machine, etc. When the work is over (and after a solid dinner) they rest sunk in an easy-chair; they spend the evening reading, listening in, and so on, still sitting in the easy-chair; or they play cards or go out for fresh air—in a motor car, and still sitting. Under conditions like that the back with all its muscles is used too little; the back will consequently be weak and stiff and will have little resistance.

There are plenty of weighty reasons for taking care of the back, for its proper nourishment, and for its development from early childhood, for its training during youth, and for the maintenance of its strength and mobility throughout life. *A good back is the mainstay of a strong, a beautiful and a healthy body.*

The faults in the back that may be corrected, bettered or arrested by ordinary educational gymnastics, are stiffness and its common accompaniment, an increase of the physiological curves, *Round Back* (*Kyphosis*), *Hollow Back* (*Lordosis*), or *Lateral Curvature* (*Scoliosis*). Stiffness is deliberately mentioned first, for stiffness is the beginning of the faults here mentioned. *Without stiffness, no faults.* This principle the gymnastic teacher must always bear in mind during his work with trunk exercises, without, however, giving himself up to a striving for excessive, acrobatic, suppleness. The recovering of lost normal mobility must be his aim. When obtained, and if the muscles of the back have been strengthened at the same time, the back will be without fault and the ideal has been reached as regards this important point in the development of the body. Throughout the years a faultless back will be preserved only if its normal mobility is kept up, naturally within the limits set by increasing age. Everybody should feel it his duty to take care of the back ; it is a duty more important than the duty to be neatly dressed.

It should not be forgotten that faults and weakness in the back may sometimes be due to congenital deformity of vertebræ, tuberculosis of the spine, infantile paralysis, or other pathological conditions. They, being outside the scope of educational gymnastics, will not be discussed here. Co-operation between the school medical officer and the gymnastic teacher is of importance here.

Round Back.

Round back (*kyphosis*) consists of a stiffness of the dorsal spine and an increase of its physiological curve.

We talk about 3 forms of round back : the *infantile round back* (*brefokyphosis*, from the Greek word *brefos*, a suckling), the *short round back*, and the *long round back*.

The *infantile round back* is generally caused by the child being placed too early and too long in a sitting position either in the cradle, on a chair, or on its mother's arm. The back will form a curve with its most prominent point situated in the lower dorsal region (Fig. 4, p. 81). In this position the front part of the vertebral bodies of the curve will be exposed to an increased pressure ; this may result in wedge-shape of one or more vertebral bodies as they are still soft and yielding (being yet far from fully ossified), and then round back has set in. It generally stretches over 2–3 vertebræ only. This round back, also called *sitting round back* because it is caused by the sitting position, may be developed during school years, too, particularly if the schooling is continued into the age of puberty, because school work entails prolonged sitting both at school and during preparation. If the food is wrongly composed or the digestive organs are not in order, the sitting round back will develop much more readily during early infancy as well as during adolescence.

The *short round back* (Fig. 30) comprises the whole dorsal region, and is therefore different to the sitting kyphosis of the lower dorsal vertebræ. It is probably not so common as the latter, but is is more generally recognised as it easily shows itself through the clothing, whereas sitting kyphosis is hidden by the dress. The poking head is also a conspicuous sign.

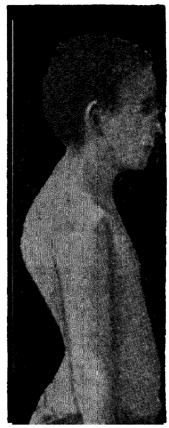


FIG. 30.—Short round back, accompanied by long hollow back.

In the short round back the upper ribs are lowered because the upper part of the dorsal spine is moved forward. The lower cervical spine goes obliquely forward in continuation of the upper dorsal spine. To enable the face to be kept forward the head must be lifted by a bending of the neck, and in that way the forward curving of the cervical spine is increased (cervical lordosis). The lower ribs are inclined less downward than normally, they may even be almost horizontal. The thorax is then nearly ball-shaped. In the short round back, as will be seen, both the upper and the lower part of the dorsal spine are curved too much: in the long round back the upper part only is curved too much, whereas the lower part is curved too little. The thorax of the short round back is short but deep and broad, the one of the long round back is long, but flat and narrow. The loin is hollowed in order to counterbalance the dorsal curve backward. The lordosis caused in this way affects the whole lumbar spine and may therefore be called long compared to the short one that accompanies the long round back. The distance between the breast bone and the pubic symphysis is increased.

It is important to note the alteration in the lengths of the spinal muscles caused by the increased curves of the short round back.

In cervical lordosis the erector spinæ of the neck are shortened; the long neck muscle in front of the spine (*longus colli*) is lengthened, and so are the muscles at the joint between head and spine, those that draw in the chin. The erector spinæ in the kyphosis region will be lengthened, and in the lordosis region be shortened. The abdominal muscles will increase in length, and owing to the increased pelvic inclination also the hamstrings are made longer, while the flexors of the hip joints

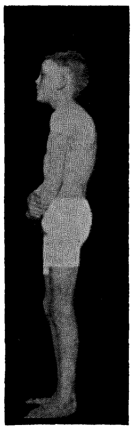


FIG. 31.—Boy, eleven years old, with long round back and accompanying short hollow back; cervical lordosis; shoulders pulled forward; "hollow chest."

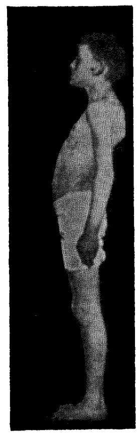


FIG. 32.—The boy in Fig. 31 standing erect.

are shortened as the hip joints are somwhat flexed, because of the forward tilting of the pelvis. If the shoulders glide too far forward, which isn't by any means always the case in short round back, the pectoral muscles will be shortened.

The spinal ligaments in front and behind will be shortened and lengthened correspondingly with the muscles. Little by little also the vertebræ will alter in shape (pp. 116 and 117).

In the *long round back* the back forms a long curve from the middle of the cervical region to the lower lumbar vertebræ

(Figs. 31 and 32, and the corresponding X-ray photo of the same boy in Fig. 34).

The curve is most pronounced in the upper part of the dorsal spine, whereas the lower dorsal spine and most of the loin are almost straight. As the upper dorsal spine is inclined forward, the head will be carried forward and a drooping head is the result. In order to raise the head and "look up" the cervical spine must be bent, consequently the cervical curve is increased (cervical lordosis). The oblique position of the upper dorsal spine causes the first 3–4 ribs to be lowered ; they may approach the vertical position and make the chest flat and hollow. The other ribs, too, are lowered more than normally, making the thorax long and narrow. Medical men call it a "phthisical thorax," a consumptive chest, because owing to its small capacity and slight mobility it disposes to tuberculosis. The shoulders protrude like a pair of knobs in front and make the chest hollow. The inner edges of the shoulder-blades are too far removed from the spine and their lower corners stick out. "The child has wings," one says. Medical men call it "winged shoulder-blades" (*scapulæ alatæ*). The lumbar curve is almost straightened. The curve necessary for the balance of the trunk is found in the lowest part of the lumbar spine, only as a more or less sharp bend between the loin and the sacrum, and it is quite short. Thus a short hollow back goes with a long round back. In bad cases the ugliness of the position will be increased by the abdomen being pushed forward ; the abdominal muscles are then slack and long, and a protruding stomach will be the result, *e.g.*, in women who have not taken care of their bodies after child birth ; they have not trained their abdominal muscles and made them shorter and stronger.

The long round back is most commonly met with in muscularly slack, badly nourished and poorly developed individuals ; it arises most often during puberty, but it is commonly found, too, in children of 5–6–7 years of age. The erector spinæ are not sufficiently developed and strong to perform the big work required for keeping the trunk upright throughout the day. They let it sink forward so that it is supported by ligaments more than by muscles. People with heavy physical work will often in time develop long round back too.

In the long round back the positions of the pelvis and the lumbar spine are in certain essential points different from those in the short round back. The pelvic inclination is diminished.

The sacrum, which in the case of a normal lumbar curve lies fairly obliquely, is tilted up and approaches the vertical. Owing to its connection with the last lumbar vertebra, the lumbar curve will be somewhat straightened, and also the

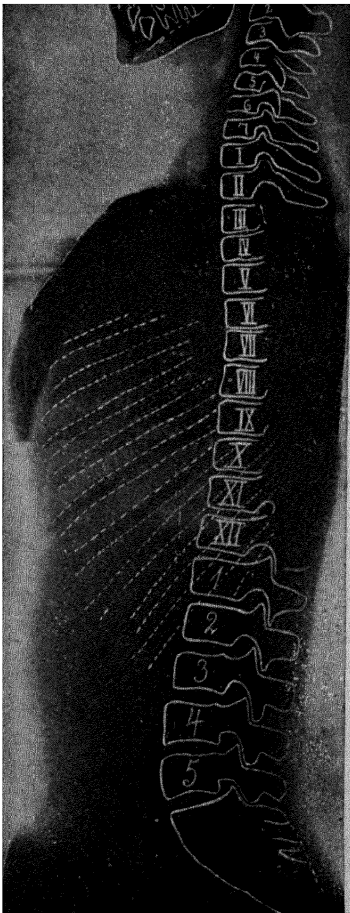


FIG. 33.—X-ray photo of a 12 years old boy (Fig. 88) standing erect. His back is sufficiently mobile to enable him to diminish the physiological curves not only of neck and loin but also of the dorsal spine.

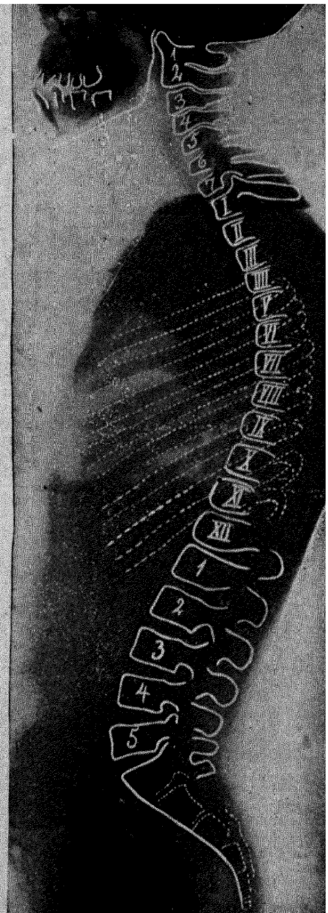


FIG. 34.—X-ray photo of the round-backed boy in Fig. 31. Here the lordosis is almost confined to a sharp bend between the fourth and fifth lumbar vertebra and the sacrum.

lumbar spine approaches the vertical position. In that way the weight of the trunk is partly carried backward and the line of gravity would fall too far behind the axis through the hip joints, if the head and the upper part of the dorsal spine were not carried forward as a counterbalance, thus rounding the upper part of the back.

The muscles will alter according to this position of the skeleton. As the normal lumbar curve is almost straightened the erector spinæ of this region are lengthened; the same is the case with those of the dorsal spine, whereas those of the neck are shortened. In front the abdominal muscles are shortened as the sternum and the pubic symphysis are nearer

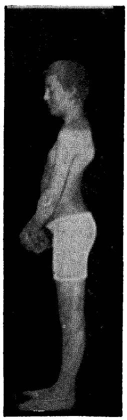


FIG. 35.—Long hollow back with short round back.

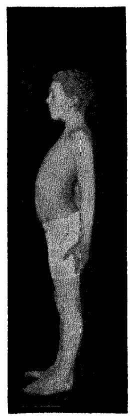


FIG. 36.—The boy in Fig. 35 standing erect.

one another than normally. In the long round back the shoulders are nearly always brought too far forward, and, therefore, the pectoral muscles are shortened.

Because of the smaller pelvic inclination, the origin of the hamstrings on the ischial tuberosity is brought nearer to the insertions on the tibia and the fibula, and these muscles are therefore shortened, often to such a degree that the knees are crooked, especially during walking.

There is no sharp border-line between the long and the short round back; there is a gradual change from the one to the other.

Hollow Back (Figs. 35 and 36) consists in an increase and a stiffening of the physiological curve of the lumbar spine. It makes itself evident in stoop position by the loin not forming an even curve but being straight in a shorter or a longer section. Just as there are short and long round backs, so there are, as mentioned before, long and short hollow backs because round back and hollow back depend one on the other. Of the cases that are treated in educational gymnastics, round back is as a rule the primary defect, hollow back the secondary. The reason is that the very mobile loin is regulated by and must adjust itself to the less mobile dorsal spine in order to compensate faults in the latter. The lumbar spine is thus affected from *above*. Its position is determined by the round back and is dependent on its development: if the round back be so new as not yet to be fixed and stiff, the hollow back isn't either, and the more the round back is fixed, the more so is the hollow back. If the round back is long, then the hollow back is short and vice versa. But also as regards degree, they accompany one another: the worse the round back, the worse is the hollow back, too.

The reciprocal action continues downward. Just as the dorsal spine—in many cases at least—determines the position of the loin, so in many cases does the lumbar spine determine the position of the pelvis, *i.e.*, the pelvic inclination.

The principal reason why round back, as a rule, is the primary and hollow back the secondary postural fault is undoubtedly that the lumbar spine is more flexible than the dorsal spine. It is so both owing to its construction and to the way it is used during daily life. It is kept mobile whereas the joints of the dorsal spine are neglected. When moving the trunk during daily work we almost exclusively move in the lumbar region. The dorsal spine is kept still. It will therefore more readily lose its mobility than the loin, and *stiffness is the beginning of deformity* (p. 86). When, during round back, the physiological backward curve is increased, the mobile lumbar spine readily increases its physiological curve forward, and the back is hollowed. This tallies with the old experience that when a round back is corrected the hollow back, caused by the round back, will be put right, too.

In certain cases one must, however, assume that hollow back is the primary postural fault. In congenital dislocation of the hips this may be taken for granted because of the greatly increased pelvic inclination. But apart from this pathological condition, the hollow back found in the young individuals with poorly developed muscles, mostly young girls, is most likely primary. The muscles moving and fixing the pelvis, especially the abdominal muscles and the hamstrings, are not of the right length, and are too weak to hold the pelvis in the correct position; it tilts forward so that the inclination becomes too great. Here, hollow back is developed from below, from the pelvis, while in the short round back it is developed from above, from the dorsal spine.

Round back and hollow back cause, as previously said, alterations in muscles, ligaments and bones.

It doesn't take long for a muscle to alter its length. When its origin and insertion are kept near together it will soon be shortened. If they are kept far apart it will be extended and lengthened. Hard work hastens these alterations. If an untrained boy during the age of puberty is put to work demanding a firm grip round a tool, his fingers may be quite crooked by night. By stretching his fingers, in spite of the pain caused by it, he may keep his fingers straight and mobile. If that isn't done his fingers will grow stiff and crooked, and the more he delays, the more difficult it will be to straighten them.

Supposing he has a hard piece of work, rounding his back throughout the day, he will be stooping at night, and it will be painful for him to straighten his back. If he does it, in spite of the pain, he may keep his back straight. Otherwise the round back will be more and more fixed, and longer time and more exertion will be needed to correct it.

If he rounds his back during sedentary work, he will also be made to stoop, although the muscles are not working hard in this case. But it will take longer. If he were in the habit of stretching himself and bending backward over the back of the chair, he might preserve a straight back.

It is a rule that the shorter length of time a *muscle* has been kept shortened or lengthened the sooner it may be brought back to its normal length. Parents and teachers should be able to detect faulty carriage early and they ought to know the few and simple exercises necessary for correcting it.

The *ligaments* do not alter in length as quickly and easily as the muscles. Presumably these alterations take place simultaneously with the corresponding alterations in the muscles. That the muscles should alter first and then the ligaments is not likely. But the process proceeds at a quicker rate in the muscles than in the ligaments. It may therefore be permissible to talk about a stage in the development of faulty posture where principally the muscles have altered in length, and a later stage where also the alteration in the ligaments is pronounced. At this stage, with the ligaments shorter or longer than normal, the normal length is only regained after long and energetic work demanding a degree of will power and endurance beyond the capacity of many people.

There is yet a third stage, the most fatal, namely, the change of form of the *bones*, generally considered to be the most firm and least changeable parts of the body.

The bones are living tissue requiring nourishment and change of matter as long as we live. Our bones are therefore *plastic*, capable of being moulded. This moulding may take place at any time of life, but the ease and quickness at which it takes place is very different at the different age periods. The less advanced the ossification is, the softer the bones and the easier the moulding. They are softest at birth and the firmness increases with the ossification. The process is, however, intermittent. During periods of rapid growth the bones are more easily moulded than when growth is slow.

But the process is intermittent from other reasons, such as faulty nourishment, want of substances such as mineral salts and a lack of the vitamins necessary for growth and ossification. The bones of a child suffering from rickets (a disease principally brought about by malnutrition) are softer and have less resistance against pressure and tension than those of a normal child. Rickets is a disease to be met with not only in infancy but during the whole period of growth, and it is found in all degrees from the worst cases involving deformity of many parts of the skeleton to the milder cases not noticed, and seemingly not leaving any effects, but being, none the less, at times the origin of deformity of the spine.

Weakness of the digestive organs may have a similar effect as rickets. It is not enough that the food contains all substances necessary for the normal growth of the bones if the organs of digestion cannot assimilate them. Illness of the digestive organs may accordingly weaken the bones and make them less resistant.

No parts of the skeleton are exposed to alteration of shape and deformity to such an extent as the spine and the teeth. They are the most sensitive parts. In order to make the spine light the vertebræ are made up of porous bony tissue. This fact, together with a heavy weight wrongly distributed, makes it subject to deformity, particularly so if rickets and malnutrition are involved.

As mentioned on pp. 80 and 82, the beginning of a faulty posture may be already made during the first months of a child's life. By adopting the sitting posture too early and keeping it too long, the front part of some of the vertebral bodies will be compressed. They will become wedge-shaped, and sitting kyphosis is caused.

Bad sitting posture at school and at home during school age, the years of growth where the bony structures are easily affected, may have the same effect if it isn't counteracted by suitable physical exercises, particularly gymnastics, and other hygienic means.

The age of puberty is the period when the spine is mostly exposed to deformity. As the growth at that time is very rapid the vertebræ will be especially soft and easily affected. During this period the young person takes up his work in earnest. He is keen to show what he can do now when he has joined the ranks of the adults. But hard physical work may at this time deform a well-built and well-developed child's body in a surprisingly short time and give it the stamp of the old and overworked. Mental work may have the same bad effect. If a young person attends school till the age of 16 or 18, or has other sedentary work without sufficient exercise, he will lack the stimulation to growth which only movement can give. Thus there are special conditions for a mis-shaping of the back through prolonged sitting.

It should be noticed that too strenuous physical exercises during puberty may have the same bad effect on the back as too hard physical work. The exercises which the young people from 15 to 18 are most easily made keen about are those of their elder and full-grown comrades, involving feats of strength and agility. These exercises are generally exercises for arms and legs, consequently these will be particularly developed, so that the development of the back will not keep up with the development of the limbs. This will endanger the back through the strain which strongly developed limbs may subject it to.

There is every reason to compare the bad effect of too strenuous exercise and the effect of too hard physical work, a matter dealt with by the Danish Dr. H. Scheuermann in his paper "Kyphosis dorsalis juvenilis." It is referred to in the introduction to dorsal exercises, p. 325 and following.

In order to secure through normal growth a healthy, strong, capable, and well-made body, growth must *neither be forced nor retarded. It must proceed undisturbed, and take its times.*

When round back arises it is not only the vertebræ that are deformed and take on wedge-shape by being lower in front than behind. The spinous processes also change form. During a bending forward the spinous processes are spread apart. If the bent position becomes habitual, the processes, being levers for the muscles, will be pulled downward by the erector spinæ that are fastened to them, and which by their pull help to keep the trunk erect. The rounder the back, the more they will be drawn downwards, and the more will they hinder a bending backward of the dorsal spine (but not a bending forward).

In hollow back, as opposed to round back, it is the rear portion of certain vertebral bodies that have to carry a bigger weight than the front part. They will by degrees be wedge-shaped, lower behind than in front.

In the hollow back compensating short round back (p. 114) it is in the middle lumbar vertebræ situated in the upper part of the curve that the wedge-shape will be most pronounced. In the hollow back which, like a sharp bend, compensates the long round back (p. 114) it is the 4th and 5th lumbar vertebræ that will be wedge-shaped (Fig. 34). The bend may be so sharp that it is found almost exclusively between the 5th lumbar vertebra and the sacrum. In that case it is this vertebra that is wedge-shaped.

Besides round back and hollow back other postural defects of the sagittal plane must be mentioned, namely the *flat back* and the *round loins*. They are both rarer than round back and hollow back, but ought all the same to be known by those in charge of physical education.

In *flat back* the normal physiological curves of the dorsal and lumbar spine are obliterated. The back is too straight, too flat. It is also stiff, lacks resiliency and looks "dead." A back of that kind is weak; its muscles are poorly developed, and for this reason scoliosis may easily be developed.

In a *rounded loin* the lumbar curve is reversed; the lumbar spine has a kyphosis instead of a lordosis. In less pronounced cases the lumbar curve is simply too straight. A back like this, however, is not absolutely without a hollow region, but the hollow part is short and pushed upward to the dorso-lumbar junction where the mobility then, as a rule, is particularly great. It is only the lumbar spine that is too stiff. The rest of the back is as a rule erect and mobile.

Certain starting positions and exercises straighten the loin so much that they may assist in producing a straight or even a rounded lumbar spine, particularly long sitting starting position and the exercises carried out in that. In stretch support kneeling shoulder stretching, the physiological curves of the back may be reversed (lordosis in the dorsal and kyphosis in the lumbar spine) with marked mobility at the dorso-lumbar junction if the hands are supported too low and the seat lowered towards the heels. Performed in that way the exercise will tend to produce rounded loin.

Scoliosis.

Amongst faults in posture (and deformities) in the frontal plane, *scoliosis* is the most common. In its milder degrees it is so generally found that both parents and teachers should be able to detect it at an early age. One never knows whether a slight scoliosis may remain mild or develop to such a degree as to become disfiguring and detrimental to health.

One must keep in mind the big work the back has to do. The long spine, easily mobile in all directions, must throughout the day and during all kinds of work carry the heavy burden of the head, the arms and the trunk and keep the trunk in such positions as not to injure the organs of the chest and the abdominal cavity. This makes a great demand on the muscles moving and controlling the trunk, the muscles which have to hold the positions required by one's work without being tired and without shifting the burden on to the ligaments. It is the extensors of the back and the abdominal muscles which will have do to this work, and they can do it, but, let it be understood, only if well developed. To make these muscles strong and enduring is therefore nothing less than the foundation proper for the whole development of the body. Only if they are strong will the body be well developed and beautifully formed.

If during growth, particularly during puberty, a period of weakness and slackness in the whole organism occurs then the muscles will, of course, be weakened too. This, as a rule, has no detrimental or lasting effect on arms and legs; they may later become strong and of normal shape; but for the back the fact that the extensors are not capable of doing their work may be fatal. The back may droop so that it will be supported more by its ligaments than by its muscles. At first the drooping takes place as easily in a forward as in a sideways direction. But soon one of the positions will be taken up more often than any of the others; it will be taken up involuntarily, it feels most comfortable, one gets used to it, it becomes a *habitual position,* after which the muscles and ligaments grow and develop accordingly: some become too short, others too long. In the end the shape of the vertebræ will be changed too; they become wedge-shaped, and the body will then be permanently deformed.

The habitual position may be formed quite accidentally; it may be formed by the sitting posture which the child at school may find most comfortable in relation to the light, the teacher or the blackboard, etc.

This form of lateral curvature is called *developmental scoliosis* because it is formed during the years of growth and development. Most often it begins at the ages between 7 and 16, that is, during the school years, which entail so much sitting. Growth puts a great strain on the young body. If the conditions are not good the state of health is impaired and all tissues become slack; fresh air, sunlight, sufficient exercise and rest, a rightly constituted diet, etc., are important. The children may become tall and lanky, shooting up like plants growing the in shade, and the development of the muscles will not keep pace with the body's increase in size and weight. The body will now be deformed easily, more easily in girls than in boys. Ten times as many girls as boys suffer from scoliosis and the general reason is undoubtedly that they are not allowed to play about as much as the boys are; they sit more, move about less, and consequently do not develop bodies with the same robustness. The sooner developmental scoliosis begins, the more it affects the growing tissues and the greater is the danger that the high degrees of deformity may be reached. It should be combated energetically as soon as it shows itself.

Young people who have been lucky enough to keep a faultless back during growth may be threatened by *occupational scoliosis,* a lateral curvature caused by one-sided bodily work or wrong working positions. Some muscles will then be developed more than others. As regards arms and legs, it is of minor importance whether one limb becomes slightly stronger than the other; but it may also lead to a one-sided development of the muscles of the trunk, the extensors of the back and the abdominal muscles. The shortest and strongest of them will now pull the spine to one side and give it an oblique position.

The one-sided and deforming influence of work is greater than it need be. If young people, whenever possible and practicable, developed the habit of changing position at their work, of using the one hand, the one side, and the one foot as much and in the same way as the other, the one-sided effect would be done away with and occupational scoliosis avoided. The Ling gymnastics was the first gymnastic system which carried through strictly the rule of equilateralness, and Sweden was the first country which applied this rule to athletics.

Occupational scoliosis is not as dangerous as developmental scoliosis as it seldom causes the same disfigurement. The tissues of the mature and strong body have greater resistance than the tissues of the young and rapidly growing body.

Mild forms of scoliosis are very common. Too little attention is paid to them, which is a sign of the small care spent on the development of the body and of the slight appreciation of a good figure. Scoliosis is, however, a deformity, it detracts from the strength and function of the back and it is a blot on its appearance.

A rarer cause is oblique pelvis owing to different lengths of the legs. When the pelvis is tilted sideways the spine will be curved laterally. The shorter leg must then be lengthened by providing the footwear with a thicker sole and a higher heel.

The sooner lateral curvature is detected the easier it is to correct it or to prevent further development. Parents and educators, especially gymnastic teachers, should therefore be able to examine a back and recognise the first signs of lateral curvature.

A patient with suspected lateral curvature should be examined with his back bare. He should stand with his back to the examiner and with the light falling straight from behind and not from the side, as in that case the shadows may disturb; the feet should be kept together, the knees straight so as to avoid any tilting of the pelvis, arms hanging freely by the sides, the trunk held in a naturally relaxed position, all stiffness avoided.

The examiner notices first whether the two halves of the trunk are symmetrical. Any difference indicates lateral curvature. If one shoulder is elevated and if one shoulder-blade is sticking out at the back more than the other a curvature in the *dorsal region* will generally be found. It is commonly said that the shoulders are oblique, whereas it is the back that is not straight.

If the lateral curvature is situated in the *lumbar region*, the spaces between the outlines of the body and the arms are unequal. The one space appears more triangular than the other. One hip is more prominent and seems bigger than the other. We say that the hips are unequal, but it is the lumbar spine that is laterally curved.

At the beginning of a scoliosis a simple so-called C-formed curve is found. But this curve will very soon be compensated by a curve to the opposite side. The scoliosis is now S-formed.

The milder forms of scoliosis may generally be cured by ordinary gymnastic exercises involving equal use of the muscles of both sides. By this kind of work the weaker muscles will increase in strength at a quicker rate than the others, so that the balance of the body will be re-established. The dorsal exercise front lying (prone lying) is an exercise of primary importance, not only for the round back, but also for the laterally curved back.

A back with lateral curvature has lost some of its mobility. Stiffness here, as in round back, is the beginning of deformity. The laterally curved back will bend further and easier to the concave side than to the convex, just as in round back where the bending forward is easier than the backward bending, and in lordosis where it is easier to bend backward than forward. It is therefore a main rule when treating curvatures of the spine to do away with stiffness and to lay especial stress on the movements that go *against* the convexity (in round back movements backward in the dorsal spine, in lordosis movements forward in the lumbar spine, and in scoliosis side bendings towards the convex sides of the curves).

The preservation of the mobility of the back guards against kyphosis, lordosis and scoliosis.

Without mobility no normal back.

When a man who has grown accustomed to a bad carriage, and whose muscles and ligaments have adapted themselves accordingly, wants to stretch his body up to a good carriage, effort is demanded of him; many muscles must be put to work to get the various parts of the body to their right place; by this the antagonistic muscles and many ligaments are stretched, so that they try to draw the parts of the body back to their usual bad positions; the good carriage is, therefore, only retained as long as the first-named muscles are kept at work. That carriage—or, speaking from a gymnastic point of view, that erect position—into which a man in this way brings his body is only his as long as he *thinks* about it and by conscious effort maintains it. It looks stiff and artificial. But the more often it is taken the stronger and more used to the work will those muscles become, which by their contraction bring the body into the correct position, and at last it will have changed from being a conscious position into being an unconscious one; it has become an habitual position, and with that a free, natural and good posture.

The individual whose back has become rounded must exert himself in order to make his back straight and to keep it straight and mobile. But a straight and mobile back with well-developed muscles means so much, not only to bodily beauty, but also to general health and strength that it is worth the trouble. A round back will soon develop into a stiff back with diminished mobility of the chest. To this may be added that the rounder the dorsal spine becomes and the more its upper half inclines forward (see Fig. 34), the more the ribs are lowered, especially the 5 or 6 upper pairs, and the flatter and narrower the chest becomes. This is detrimental to the lungs which, as regards development and function, are dependent on the form and mobility of the thorax.

The increase of the dorsal curve will also produce a shortening of the trunk, so that both the thoracic and abdominal cavities become shorter. The size of the lungs depends on the size of the chest cavity, but the contents of the abdomen can hardly be compressed; they will be displaced. What the abdominal cavity therefore loses in length it gains in thickness. The round-backed individual is therefore stout round the waist, the one with an erect carriage is slender round the waist. Furthermore, in the case of the round back the sinking together means that the weight of the upper part of the trunk is partly supported by the abdominal viscera, causing a pressure which may lead to functional disturbance.

When a bad carriage is to be corrected by gymnastics, it is of importance that the teacher should be clear as to what really is wrong with the positions of the various parts of the body, and what means he should use to correct them.

If *round back* (Fig. 34) is to be corrected it is useless to require people to contract the dorsal muscles, as this gives them no idea of what they should do. Neither does it help to tell them in general to stretch their back, as that generally only causes them to move the top of the trunk backward by a

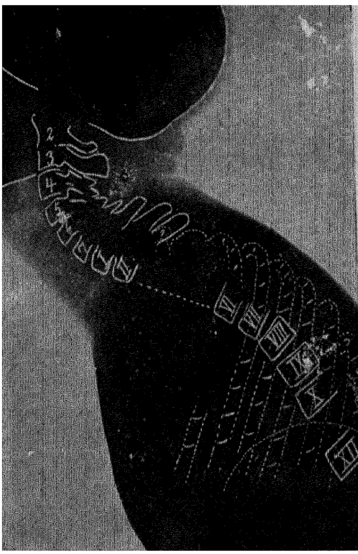


FIG. 37.—The curve of the cervical spine (cervical lordosis) is drooping head with the chin pushed forward.

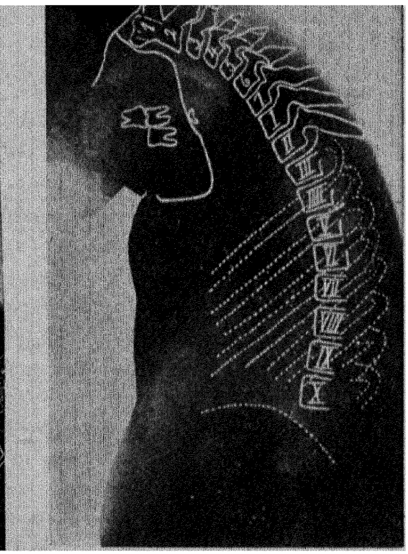


FIG. 38.—Cervical lordosis straighten by a pulling in of the chin. By carr ing the head backwards with the ne fixed in this position the dorsal spi will be straightened.

hollowing of the loin—a fault well known from the erect position of earlier times, both with civilians and military people. On the other hand, we can make them take movements with the head and pelvis, and when these are brought into the right position the parts of the spine which lie between them will also have taken their normal shape.

The head must be moved back with the chin drawn in. When the chin is drawn in, together with the bending forward of the head, a straightening of the forward convexity in the cervical vertebræ takes place (Figs. 37 and 38), and a drawing backward of the head, with the chin fixed in this position, can only take place by a movement in the middle part of the dorsal spine by which the upper half of the spine is moved from the forwardly inclined position towards the vertical. This small movement is of great importance, as the results will show.

Firstly, the upper ribs are raised, giving more space for the lungs. A comparison of the positions of the ribs in Figs. 34, 37 and 38, and in Fig. 33 shows this clearly.

Secondly, the effect will make itself felt in the lower half of the dorsal spine, in the loin, and in the position of the pelvis. To maintain balance, all these parts must alter their relative positions. When the upper half of the dorsal spine is brought almost into the vertical position the lower part also must be raised. If the spine in Fig. 34 is to be brought into a position like that in Fig. 33, the top of the curve must, so to speak, be pushed forward. This will result in a straightening also of the lumbar spine, so that the sharp bend backward in its lower part is diminished. The spaces between the 4th and 5th lumbar vertebræ and between the 5th vertebra and the sacrum will be less wedge-shaped. Through that, also, the position of the pelvis will be altered.

These alterations in the spine will make the individual ¾ to 1½ inches taller.

As the head is heavy (it weighs about 8 lbs.), strong neck muscles (cervical erector spinæ) are needed to carry the head throughout the day and throughout life. These muscles demand strong exercises for their development. Head support hanging ; fall sitting, body raising in pairs ; back lying, shoulder raising with a slight raising of the seat from the floor, all belong to the most powerful exercises for the neck muscles, of which some of the strongest come from the middle of the dorsal spine, and, therefore, besides pulling the head backward, draw the 5 or 6 upper dorsal vertebræ back (compare p. 201). Also ear stoop standing, trunk stretching forward ; front lying, trunk bending backward (especially with the arms in ear position) have a good effect on the muscles at the back of the neck.—In this connection it is worth noticing how strong the back muscles are in little children. Not only are they able to carry their heavy heads with ease when lying prone, a position they like, but lying on their backs they are able to raise them selves in an arch, only resting on the back of the head and the heels. Therefore, the muscles are strong originally; they only need proper impulses to keep strong during development. Older children interested in reading often lie on their stomachs in an arched position with the book in front of them. There is every reason to encourage this, as in that position they develop strongly the muscles at the back of the neck and secure a good carriage. Also the breast stroke in swimming produces an arched position, consequently this exercise adds to its other good qualities its contribution towards a good carriage.

Hollow back is corrected by moving the pelvis forward so that its inclination is lessened to the necessary degree. In the frequent cases where the hollow loin is accompanied by an increased curve in the thoracic vertebræ an effort must be made to stretch this out, which will already have been done to a certain extent by the decrease of the bending in the loin. The upper part of the thoracic spine is brought into its right position by the head being brought to its normal carriage as described above.

However, if an habitually bad carriage is to be worked away, it is not enough to use the erect position as the means for doing so. Just as a bent stick is most easily straightened if it is bent past the straight position over to the opposite side, so it is also easier and quicker in correcting the body to bring it right over in the opposite position. There are exercises enough which will procure this. Even if the dorsal part of the spine cannot actually be bent in the opposite direction, it can be straightened out more fully than it is in the erect position by such exercises as head bending backward, trunk bending backward; span bending, the stretch position, prone lying, etc. The over-hollowed loin is stretched by exercises such as back lying, high leg raising; hanging, knee raising (especially high knee raising); lean standing, trunk bending downward, etc. The too straight loin is corrected by trunk bending backward; span bending; prone lying; sitting, trunk leaning, and bending backward to the floor, etc. The hamstrings, which are in the last case nearly always too short, are stretched by exercises such as trunk leaning forward; lean standing, trunk bending downward; four-standing, knee stretching; marching with leg swinging forward; march with knee raising and stretching, etc. Shoulders which hang forward are brought to their right place by such exercises as arm bending, arm flinging, certain body raisings (*e.g.*, in fall hanging and over-grasp hanging), and the like, by means of which the muscles which pull the shoulders back work strongly in shortened condition, while their antagonists are stretched. In this way we could go through the whole body, and for each part find exercises which can help much more strongly in putting this part into its right position than can the erect position. Indeed, most exercises have such a form, and have to be performed in such a way, that each of them gives its share towards producing and maintaining that good carriage of which the erect position should be the expression.

It is of the greatest importance for the teaching of gymnastics that the pupils should grasp the importance of the erect position. It is the teacher's art to give them, from the very first, interest and respect for it. The more trouble he gets them to take over it, the more quickly will he improve their carriage, the more beautiful and effective the whole gymnastics will be, and the more physical education the pupils will take with them into life from the school.

If the pupils are to gain respect for the erect position, the first condition is that the teacher should take trouble over the command. As the taking of the position is a fairly complicated exercise, it is good now and then, especially with beginners, to command it slowly, as the pupils can then better learn to perform the details correctly (see p. 46).

Another condition which must be fulfilled if the pupils are to gain respect for the erect position is that the teacher not only demands that the position be taken correctly, but also that it be kept exactly until "stand easy" is commanded.

The teacher, as stated on pp. 45 and 53, must not make the pupils stand in the erect position while he gives an explanation or important corrections.

Common Faults. (a) The position is stiff and tense because muscles that should not be working are contracted. Only the muscles that make the spine longer by diminishing its curves should be working, *i.e.*, those that place the pelvis and loin in the right position together with the dorsal part of the erector spinæ and the muscles that keep the neck straight and the head lifted.

(*b*) Faults in the spine (the position of the head included) as described above.

(*c*) The shoulders are drawn up as they are pulled backward. Attention can here be drawn to the fact that when the head is brought up into its correct position the shoulders will, as a rule, follow practically of themselves, as they hang in muscles which come from the cervical vertebræ, especially the lower ones (middle part of trapezius). It is, therefore, more important to remind the pupils to lift the head than to tell them to pull the shoulders back, as one often sees, especially in round-backed people, that the shoulders are pulled back without the head being lifted, and they will in that case always be drawn upward.

(*d*) With some people the arms hang bent at the elbows in the erect position This fault is mainly found with people who have been made stiff by work or in some such way, and it is nearly always together with the fault of the shoulders being drawn backward without the lifting of the head. The oblique position of the shoulder-blades causes the upper arms to point somewhat backward. The arms are often, in addition, held away from the body.

(*e*) The wrists are bent so that only the tips of the fingers touch the thighs.

(*f*) The palms face backward. They are held too far forward or (more rarely) too far backward.

(*g*) The knees are not stretched and together.

(*h*) The one heel is somewhat behind the other and the one foot is more turned out than the other. Thus the body comes to stand obliquely.

The Muscular Action of the Erect Position. The chin is drawn in by *rectus capitis anticus major and minor* ; the curve in the neck (neck lordosis) is stretched out by *longus colli* ; the head is drawn back and the dorsal curve stretched by the neck part of *erector spinæ*, by which the chest is lifted. If the bending in the loin and the tilt of the pelvis are too great the *abdominal muscles* (especially *rectus abdominis*) and the *extensors of the hip* must work in order to keep the correct distance between the pelvic rim and the thorax. The shoulders are pulled back by the *middle part of trapezius* and the *rhomboid muscles,* which at the same time lift them ; the lifting is prevented by the *lower part of trapezius.* The body is prevented from falling forward in the hip-joint by the *hamstrings.* The knee-joint is kept stretched by the *quadriceps* ; with many people, however, this muscle is not put into action at all. The *calf muscles* prevent the body from falling forward in the ankle-joint.

It cannot be emphasised too strongly that good carriage is not attained by simply doing exercises which promote good posture, in the gymnasium. Such exercises may prepare the way for good carriage; they may do away with stiffness which is a hindrance, and thus enable the pupil to take up the proper posture. For one suffering from poor posture such exercises are a necessary preparation, but only the first step. The erect posture must be acquired. Very often one comes across a gymnast with a good carriage in the gymnasium, but a poor one elsewhere. He seems to have discarded the erect carriage with his gymnastic costume. If he is to make it part of himself he must get to look upon it as something of positive value, not only in the gymnasium at a display, but throughout life. When he has come to look upon it in that light he will endeavour to do his work in good working positions and keep erect and straight throughout his daily life. By such an endeavour his nerves and muscles will be trained in keeping the various parts of the skeleton in their proper relation to one another; he will feel the attitude free, easy and comfortable, and unwittingly he will return to it after work that has demanded some other posture. Not till then has the good carriage become second nature.

The good carriage must be attained and kept without loss of mobility. Just as the back may be stiff in poor carriage, so it may be stiff in erect carriage. In either case, stiffness is a loss, both æsthetically and hygienically. The good posture must be maintained by muscles, not by ligaments and bones.

Changing fashions show us by examples that people may alter their carriage when they make a point of it. Women wishing to be fashionable have shown how quickly (provided they have kept their mobility) they have been able to adopt a new posture, namely, that recent fashion with the hips pushed forward (diminished pelvic inclination), straight loin, curved dorsal spine and drooping head, all in order to attain the fashionable "slender line." They *will* have this posture, and their will forms the body.

Another example may be taken from the army. The ideal soldier has a straight back. If that ideal is taken up by the recruits they will have a better carriage when leaving than when joining the ranks.

In the case of children the gymnastic teacher must from the beginning draw their attention to any faults in carriage by showing them pictures, and demonstrating and explaining, or by making them look at themselves in a mirror. The next step is to do away with any stiffness that may be found, teach them to take up the proper posture, and make them feel it so that their muscular sense is trained. Finally—and this is his most difficult task—he must awaken in them a desire to have a good carriage and encourage them to work towards its attainment. But at the same time he must make it clear to them that the really free and natural carriage is only gained by a thorough training of the whole body.

Fortunately, it is not difficult to arouse the children's interest in their own bodies, and the teacher may make them his enthusiastic co-workers. When he has succeeded in this, good results may be looked for. It is with physical education as with mental; it demands effort by the individual himself.

The carriage is not an indifferent outward show. It is a visible sign that the body is in order and well disciplined and trained. It is not won once and for all as a possession not to be lost. It will be lost if it isn't constantly regained. It demands that the training of the body be kept up. That is the price of it. It demands nothing less. Is it worth it? Few fulfil these demands. Many are of the opinion that they may live happily with a poor carriage and with that beginning of bodily deterioration which invariably accompanies it. But the people who have fulfilled the demands and paid the price are those who can give a weighty answer. And they agree that the price is not too heavy and that it is easier paid than one would think.

B. The Position of Ease

With the left stand—easy! The left foot is moved about a foot length obliquely forward, while the weight of the body is brought over on to the right foot. Care must be taken that the pupils do not stand slackly, but keep a good carriage (Fig. 39).

The position of ease should be commanded with the right foot forward, as often as the left, as that side of the pelvis on which the foot is put forward is lowered, the pelvis stands obliquely, resulting in an oblique position of the spine (Fig. 40). If a child acquires the habit of always resting on the same foot, both in and out of the gymnasium, it is in danger of developing a scoliosis.

It should be noted that it is worse to sit obliquely, as so often happens in reading, writing, sewing, etc., than to stand on one side, because a child sits still much longer than it stands still.

§ 13. Order Exercises

Order exercises serve in an easy, quick, and orderly way to give the pupils that arrangement and distance which the various exercises need. They include falling in, opening lines, taking

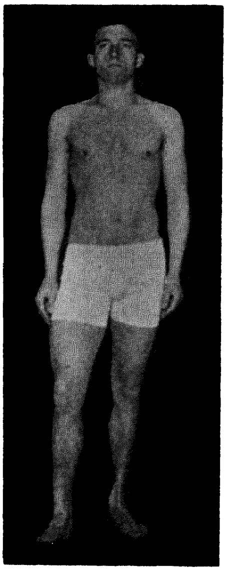


FIG. 39.

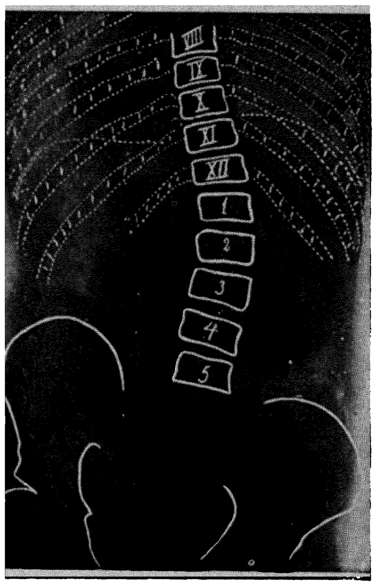


FIG. 40. The oblique pelvis and spine in the position of ease.

distance, turnings, steps, and the like. They are exercises which do not claim a special amount of exertion, and therefore are not of the same importance for the development of the body as the exercises in the other groups; but they are, nevertheless, very valuable in themselves, as they generally claim quickness, precision, and exactness of performance. They thus necessitate great attention and heed in the pupils, and in this way have a disciplinary effect.

A. Order Exercises for Older Children and Adults

1. **Class Arrangement.** *In 1 line (2 lines)—fall in!* The pupils all take the position of ease in 1 or 2 lines in the order pointed out, the right-hand leader 2 steps in front of the teacher, facing him, each pupil about a hand's-breadth distance from his neighbour. The second line stand 1 yard behind the first. This arrangement is called *rank arrangement.* If a turn (quarter circle) is taken from this position the pupils are standing in *file arrangement.*

2. **Covering.** (*a*) *Rank Arrangement.—Eyes right (or left) and line—straight!* The exercise is commanded from the erect position. All, with the exception of the leader on the right, turn their heads so far to the right that the left eye is exactly over the middle of the chest, and with small quick steps get into a straight line. The line is straight when each can just see the chest of the one standing third from him.

Eyes—front! All quickly face straight forward.

Another method. *From the centre—cover!* All cover in the same way from the one in the middle who has been indicated.

Common Faults. In covering to the right the feet are turned to the left, the left shoulder is moved somewhat backward.

(*b*) *File Arrangement.—Cover!* All quickly get into line behind the leaders.

3. **Turnings (or Facings).** There are various turnings: Half turnings (45 degrees), turnings (90 degrees), and about turnings (180 degrees). *Half left—turn!* (*or face!*). *Left—turn! Left about—turn!*

Turnings are taken in 2 movements. In turning to the left, the first movement is a slight lifting of the ball of the left foot and of the right heel; as the right knee, which has been a little bent during the lifting of the heel, is stretched, the turning is taken on the left heel and right toe; the ball of the left foot is then put on the ground, turned outwards as in erect position, while the right heel is kept well up, the right knee is stretched, and the weight of the body is resting entirely on the left foot. The arms are kept still during the move. In the second move the right foot is moved up to the left, so that the feet are again as they were in the erect position.

Introduction. Children most easily learn to turn when one begins by making them turn on the one heel, with a push-off from the ball of the other foot, without any command and quite freely as regards the size of turning.

Turnings (or facings) should be practised for a long time by numbers before they are taken in time. The command is then, for example, *Left turn by numbers*—1—2. On 2 the foot is brought up with a sound. When one changes to taking turnings in time the sound on the last move should still be used for some time. Not until the performance and the time are well trained must one dispense with the sound.

Common Faults. (*a*) By turning to the left the right knee is not stretched; the first movement is then too slow and the turning stops too early, especially in about turn.

(*b*) The arms swing during the turn.

4. **Steps.** (*a*) *Steps to the Side.* 1 *step to the left—march!* (Time counting—1, 2). The left leg, slightly stretched, is moved sideways; at the same time the right foot pushes body over to left by unrolling of foot as in marching. Left foot is then placed on ground one step distant, the ball of the foot touching the ground first, then the right foot is brought up to it.

If 2 or 3 steps are to be taken one after the other the heels are kept lifted, just as in marching sideways, until the end of the last step.

(*b*) *Stepping Forward.* 1 *step forward—march!* (Time counting—1, 2.) As we always (with the exception of children in first year) begin with left foot, this foot is moved forward as in beginning of ordinary marching, and right foot brought up to it as in halt during marching.—2 and 3 steps forward are also taken.

(*c*) *Stepping Backward.* 1 *step backward—march!* (Time counting—1, 2.) As the left foot is always moved first, just as in stepping forward, this foot is moved a short step backward, and put on the ground with the toes down first; at the same time right foot pushes weight backward and then is brought up to left.—2 and 3 steps backward are also taken.

5. **Numbering.** *In twos—number!* The right-hand leader turns his head quickly to the left towards his neighbour, and says "1," and at once faces straight forward again; the next makes the same move and says "2," and so on. The last one does not turn his head. Numbering can either be taken from erect position or from position of ease; in the latter case each stands to attention as he says his number. If the pupils are standing in 2 ranks, only the front rank says the numbers, and in the second rank each takes the number of the one in

front of him. It is sometimes useful to number in threes or fours; in such case, this must be stated in the command (*e.g.*, *In threes—number !*).

6. Opening and Parting Lines (i.e., Moving to Open Order). (*a*) *In* 1 *File.*—After numbering off in twos: *Ones* 1 (2) *step to the left, twos* 1 (2) *step to the right—march !* After some practice the command can be shortened to: *Open file—march !*

To close the line, the steps are commanded in the opposite direction, or after practice: *Close file—march !*

After numbering in threes: *Ones* 2 *steps to the left, threes* 2 *steps to the right—march!* To return, the command is: *Close file—march !*

(*b*) *In* 2 *Files.* From file arrangement: *With* 2 *steps open files—march !* The lines are opened as after numbering in twos under (*a*), both files first taking 2 steps outward. Closing the lines as under (*a*). Then: *With* 2 *steps close files—march !*

After some practice, parting and opening the files and closing and joining the files can be taken together (*e.g.*, *Open Files—march*—1, 2, 3, 4).

7. Taking Distance. When the pupils are in rank arrangement in 1 line the teacher commands: *From the right, single arm distance—take !* The right-hand leader does not move, the others move quickly to the side, with small steps as in running sideways; when they are at about arm's length distance from one another each supports the fingers of his right hand against the top of his neighbour's arm, and then takes exactly arm's-length distance with arms stretched, at the same time each turns his head to the right and gets into line. On the command, *Hands—down !* each turns his head quickly forward and brings his hand quickly and noiselessly down to his side.

If distance is to be taken from the middle of the line the command is: *From the centre single arm distance—take !* All then run to the side from the one in the middle, all hands pointing towards the centre, one placed on the shoulder of neighbour in every case; all then turn heads toward the centre and cover.

If double distance is to be taken—that is, if there is to be 2 arm-lengths distance between the pupils in the same line—the teacher commands: *From the right* (*centre*) *double arm distance—take !* The running sideways and covering is taken as described above, but the distance is increased to 2 arm-lengths; both arms are moved to the side, and the fingers of each pupil just touch those of his neighbour. Leaders only raise the arm nearer the centre. On command: *Hands—down!* the head is turned quickly forward and both hands are brought to the sides quickly and noiselessly.

When distance is taken in rank arrangement in 2 ranks, the pupils in the second rank get into line behind the ones in front of them without raising arms sideways, as, if they did so, the distances would not be the same in the 2 lines, because of the difference in the lengths of arms.

To the right (centre)—close! All run quickly sideways to the original place, cover, and look straight forward.

It is of importance that each pupil is at a sufficient distance from his neighbour and the one in front of him, during free standing exercises. If the lines are opened from ordinary (hand's-breadth) distance from each other, the distance is too small, especially for children. When the size of the gymnasium allows, this distance should be increased. This can be done be letting the pupils take distance in file arrangement before the lines are opened. On the command, *Distance forward—take!* the pupils move so far backward that they can just reach the back of the one in front of them with the tips of their fingers. It can also be done by taking distance in rank arrangement. On the command, *Elbow distance—take!* the pupils put the right hand on the hip and move so far to the side that the right elbow just touches the left arm of the right-hand neighbour.

8. **Changing Ranks.** In many places, especially with exercises which need living support, it may be necessary that the lines, or ones and twos, should change places. This is done on the command: *Ranks (ones and twos) places—change!*

The ones then take a step obliquely backward to the right and another obliquely backward to left, while at the same time twos take a step obliquely forward to left and obliquely forward to right. If the pupils are standing at a short distance from their neighbours it may be necessary first to take a half turn to right before changing places; this must then be commanded. In the last step a half turn to left is then taken.

9. **Falling Out (Dismissal).** *Fall out!* Falling out at the end of the gymnastic lesson may be done by boys and men in the following way: Left foot is moved backward a short step, right foot is brought back to left; at the same time a bow or hand clapping is made.

For girls and women the falling out, which can be taken to the same command as for men, may be a curtsey. This is done by little girls as follows: Left foot is moved behind the right and a little quick knee bending is taken, after which the left foot is moved back to the right. With older children and adults the left foot is moved a step obliquely backward, the knee bending being taken more slowly. While the weight of the body during the knee bending is brought over the left foot, a slight bow is made with the upper part of the body, after which the knees are stretched and the right foot is moved up to the left.

The teacher may employ other devices, but always the dismissal should be definite and as brightly performed as was the initial "fall in" of the lesson

10. **Greeting.** The pupils should be trained to greet the teacher when they pass him, the boys with a polite lifting of the cap, the girls with a curtsey. Further, they should be trained to bow and curtsey respectively when they are called to or leave the teacher and when they shake hands in saying, "How do you do?" or "Good-bye."

B. Order Exercises for Infants

11. Arrangement, Numbering, Opening and Closing Lines

The order exercises begin already in the dressing-room. The teacher tells the children how and where to put down their daily clothes and footwear, he hands out the gymnastic shoes and costumes if the school supplies them, etc. Here, where the children are close at hand, he may instruct them as to their work and behaviour in the gymnasium, *e.g.*, tell them not to climb up into the apparatus when entering the gymnasium, how to obey signals by whistle (excellent practice for inculcating discipline).

For the teacher it is important from the outset to keep the children well in hand while they are in the gymnasium. Climbing up anywhere is not allowed, but otherwise they may run about, skip, jump, and dance to their heart's content. As soon as they hear the whistle, however, they must stand still, with feet together and facing the teacher. This practice should be taken as a game often enough to make it a habit for the children to obey the whistle. If quietness is not restored at once the teacher should not become nervous and blow the whistle repeatedly. If he keeps calm he will soon be able to control the children.

At the beginning of the first few lessons the children may be gathered together at one end of the hall. At a signal they all run forward till stopped by the whistle. They may now be spread so far apart as to give sufficient room for the standing exercises, if not, the teacher may tell them to move further apart.

But soon they must learn to fall in, in lines. In schools where the children form up to go to their class-rooms after the interval the gymnastic teacher should see that they stand in the order in which he wishes them to stand for their gymnastic lesson: two bright children as leaders, the others arranged according to height, the small ones in front, the partners within each file of approximately same size and strength, as they often have to work together at the exercises.

Arranged like that in two lines the children are made to walk round the hall hand in hand. Sometimes they break away from one another on the teacher's command, but at a given signal they must quickly find their partners and their places.

If there is an equal number of wall bars along the two side walls—and that is how the wall bars should be placed, each section with a number painted on it—the teacher may teach them to walk to the bars, each line to its wall and each child to its section. A quick running to and from the wall bars should also be practised.

Open order—generally in 4 lines—may be introduced in the following way. Towards one end of the hall four chalk marks are put at suitable distances. The leaders of the two lines stand behind the first and the third mark respectively, the second child of each rank behind marks Nos. 2 and 4. Behind them the "ones" and "twos" of each line are placed by the teacher. The children now turn to the left, join hands, and move down to the left till their arms are stretched, and they will now have sufficient distances for the exercises. This arrangement is repeated till the children master it. They will often draw together during the exercises so that the joining hands and taking distance will have to be repeated.

Care should be taken not to weary the children with order exercises. Their object is to arrange the children in the best way for the various exercises, and at the same time they have a disciplinary effect; but the children may be taught discipline at any time during the lesson so that it isn't necessary to practise order exercises too long. The rule is: Finish the order exercises quickly; get to work!

The children may also be arranged across the hall in as many ranks as there are squads (teams). Each leader stands opposite his mark on the side wall. This arrangement demands a hall sufficiently broad to allow double-arm's distance within each squad.

Later, one can pass over to the ordinary arrangement in 2 lines, so that the pupils fall in in file arrangement, from which they get to rank arrangement by taking a turn (90 degrees); the lines are still arranged so far apart that no further parting is required; but, on the other hand, the lines must now be opened. In file arrangement the children must stand at arm's-length distance from the ones in front. Numbering in ones and twos is done at first by the teacher, who goes down the line giving the numbers; later the leader of each line does the numbering in the same way. To make the opening of the lines easier one may tell number ones to raise the left, twos the right arm sideways to make it clearer in which direction they are to move.

Besides these arrangements for free standing exercises the children must early be trained to find their places quickly at the various pieces of apparatus and in teams. This taking of places now and then should be done several times in succession before the apparatus is used.

12. **Turnings.** With small children turnings are taken with a little jump. As long as it is necessary the teacher must point out which way they are to turn by means of objects which are near, for example: *With a jump towards the door (square ladder, etc.), left (or right)—turn!* Later the teacher shows the direction of the turn with his hand, commanding: *Left (right)—turn!*

13. **Steps.** With children of 7 to 8 years, steps are practised freely without a certain fixed movement of the legs. Steps to the side are most easily introduced when the children stand in file arrangement, each with his hands on the shoulders of the one in front. In taking steps forward and backward it need not be at once insisted upon that the children begin with the left foot.

14. **Falling Out and Greeting.** Both these have been dealt with in A (pp. 185 and following).

15. Moving the Apparatus. The children must be trained early to bring the apparatus forward and replace it again quickly and surely; small children, particularly, must have special practice in doing this with every new piece of apparatus they use. A sufficient number of children are sent to each piece of apparatus to manage it with ease, but not more children than are necessary should be sent.

§ 14. Leg Exercises

Introduction

The legs are our natural means of locomotion. We use them in walking, running, and jumping. As they have to carry and move the whole weight of the body the work they must do daily and throughout life is enormous. As a rule, this work is not felt to be very great, and the reason is that the muscles of the legs, the muscles around hip, knee and ankle joints, are the biggest and the strongest in the whole body. They make up about two thirds of the whole mass of muscles in the body. They are the muscles for walking and running. It is through walking and running they have been developed and made so strong that the work, which walking and running is, is carried through with ease.

The development of the legs is an important part of bodily development. If one's legs are strong, one has a desire to move and be active. It is by using our legs that we provide ourselves with that exercise which is needed for the sake of health. Weak legs diminish one's desire to move and tempt one to take it easy reclining in a chair.

Muscular work may be looked upon as a fly-wheel that starts and keeps going all the other wheels of the human machine. This holds good in particular when we consider the primary physiological activities such as breathing, circulation of the blood, digestion, and metabolism. The organs involved will be developed, kept active and healthy. As the greater part of our muscular work is performed by the big muscles of the legs, it is obvious that the development and use of the legs are important to health in general. This simple truth has been recognised from the oldest times. From the dawn of history, running has been considered a classical exercise amongst physical exercises. The ancient Greeks, surpassing all in physical education, had running as the most important exercise at the Olympic Games; during the first three fourths of the first century of the recorded history of these games it was their only exercise. The Greeks, however, soon saw the one-sidedness of this and added throwing and wrestling in order to give the arms and trunk the proper development. In this way they founded the famous five-sided contest (pentathlon) giving that physical harmony for which they were striving. M. A. Furtwängler, a connoisseur of Greek sculpture, writes: "Without exaggerating in the slightest one may say, Greek art is unthinkable without Greek gymnastics."

The English have had a similar understanding of the necessity of running as part of physical education. Their most important physical exercise has for centuries been ball games, and in ball games running is the most important part from the physical point of view. But it involves a certain amount of one-sidedness. The Germans have gone to the opposite extreme. On the principal German apparatus, horizontal bar and parallel bars, the arms alone have to carry, move, swing, guide, and control the whole body. This one-sidedness is far more harmful than the one met with in the English games. The muscular work performed by the arms on the German apparatus is, measured in kilogramme-metres, much less than that performed by the legs in ball games, and the physiological effects are correspondingly less; but what is worse, the movements of the chest are hampered by the work of the arms in exercises on horizontal and parallel bars, and this again hinders the activity of lungs and heart; during running, on the other hand, the chest is able to move freely.

Mountain dwellers are generally better developed physically than those living on the plain because they have to use their legs powerfully, particularly when such an excellent exercise as ski-running forms part of their lives.—Town dwellers have in their staircases a slight substitute for hills. Regarding the legs it is better to live on the fourth storey than on the ground-floor.

The ballet affords the best example of what good development of the legs means. The ballet dancers obtain their beautiful bodily development almost exclusively through the training of the legs. Running gives strength to the legs, but the exercises of the ballet give suppleness, too, which is a valuable addition. The ballet training gives suppleness to the hip joint especially; by that a considerable effect on the trunk is obtained. The pelvis is moved strongly during the many leg swingings used in order to make the hip joints mobile, and the movements of the pelvis are accompanied by corresponding movements of the loin so that the extensor spinæ of the lumbar region and the abdominal muscles will be exercised too. When free mobility of hip joints and pelvis is combined with muscular strength, the conditions are present for lightness, elasticity, and beauty in walking, running, jumping, dancing, etc.—It should, however, be added that also in the ballet dancer's training a certain one-sidedness is found: the dorsal spine, the shoulders, and the arms do not obtain training corresponding to the training of the legs. This one-sidedness is, however, somewhat counteracted by the stress laid on the dancers keeping trunk, arms, and head in beautiful positions.

Besides the principal exercises for the training of the legs, namely walking, running, and jumping (and dancing, which, like running, includes a number of light jumps), gymnastics comprises a series of exercises, mostly easy ones, collected in a special group under the name of *Leg Exercises.* These exercises serve various purposes.

Some of them provide good *starting positions* for other exercises; stride position, to take an example, is a much used and good starting position for important trunk exercises owing to the stablity and firmness which the position gives.

Some leg exercises help to do away with faults in the movements of the legs during walking by practising fine movements of the legs, particularly as regards bending and stretching of knee and ankle. These are especially *foot placings forward, outward, sideways, backward, and obliquely backward.* When the foot is placed with the sole of the foot on the floor the trunk moves with it so that it comes to rest equally on both feet. If the foot placing is performed with toe support, the weight of the body remains on the stationary foot, an easy and graceful form of foot placing which should not be neglected.

During marching and running, the movements in the joints of the legs are fairly small, far from reaching the limits. One might consequently think that great mobility of these joints were not needed; this is, however, far from right. If the mobility of the legs be not kept up, walking (and still more running) will be marked by stiffness, commonly seen in elderly people who never indulge in bigger movements of their legs than those required by walking.

There is every reason to include in our gymnastic exercises such as will train and keep up the full mobility of the legs.

Some of the best exercises for this are *knee bendings* in their different forms, particularly full knee bendings. By the heel raising, with which knee bendings generally begin, the ankles are stretched fully, and they are fully bent in the spring sitting position. The knee joints, too, move from full extension to full bending. In the hip joints, however, the limits of movement are not reached.—It is important to press the knees outward during knee bending so as to counteract knock-knee. This outward movement takes place in the hip joints, and the abductors must be accustomed to withstand the pull of the abductors which are too short in the case of knock-knee. Knock-knees are generally a sign of badly developed legs and give ungraceful walking (and still more ungraceful running). A good training of the legs, for example by gymnastics or games, is able to correct minor cases of knock-knee.—The keeping the knees together during knee bendings, a form, that has spread throughout gymnastics for women lately, is a bad fashion, so much more to be deplored as owing to their broad pelvis women are more apt to be knock-kneed than men.

Knee bendings are good preparatory exercises for jumping, the take-off as well as—and especially—the landing. The landing is in itself a splendid powerful knee bending as the muscles of the legs have to stop the speedy downward movement of the whole body. Anyone who is able to perform a good landing with ample bending of the knees has strong legs.

Knee bendings in one knee will increase the work of the supporting leg almost twofold. To these exercises *lungings* belong. In lunging outward, forward, obliquely backward, and backward the supporting knee should be bent till the, lower leg is parallel with the other leg; this form is found in Greek sculpture. It is the most beautiful as well as the most powerful form. In gymnastics for women a still deeper knee bending is coming into use, and that is all to the good. From broad stride position, a full knee bending in one knee may be done.

In these lunging exercises both feet rest on the ground; but in *kick standing, full knee bending*, one leg has to carry the whole weight of the body. Young people ought to aim at mastering this exercise easily and surely. It cannot be done without a good development of the legs.

Skip jumps and *dancing steps* form the transition from leg exercises to running and jumping. They are little jumps, mostly on the spot, as running is a series of little jumps forward. Although there is a "give" (a slight bending and stretching) in the knee and hip joints, the principal movements in these exercises take place in the ankles, and it is the calf muscles which have to do the main work. The strain is great, especially when hopping on one foot: one set of calf muscles has to throw the body into the air. These exercises are therefore very suitable in developing the calf muscles. These muscles ought to be strong because, like powerful springs, they must be able to carry and lift the whole body with ease and with endurance and to make walking, running, dancing, and jumping

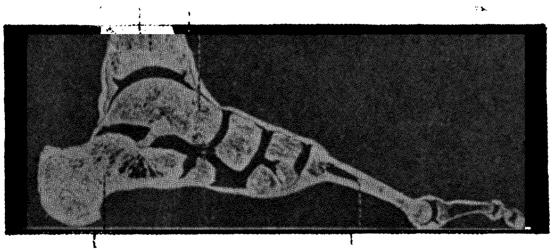


FIG. 41.—The arch of the foot.

springy and graceful. To be "light-footed" is no mean praise. Just as beautiful as a strong calf and a slender ankle are, just as ugly are a thin calf and a thick ankle.

These jumping exercises are good preparatory exercises for landings, as they train the calf muscles to give elastically just at the moment the foot touches the ground. Heavy landings are often just as much due to tense and unyielding calf muscles, which make the ankles stiff, as to tense muscles at knees and hips.

When discussing leg exercises it should not be forgotten that the foot is a part of the body, the development of which must not be neglected. Like the back, the foot has an intricate bony structure. It has 7 tarsal bones and 5 metatarsal bones besides the bones of the toes. When the above 12 bones are rightly placed they form two arches, one longwise, a long arch, the arch of the foot (Fig. 41), and one crosswise, a short one at the end of the metatarsal bones. These arches make the foot springy and help to make walking, running, jumping, etc., light. The whole weight of the body rests on these arches and the pressure exerted is doubled many times when the body comes down speedily in a landing or a fall. The foot is therefore exposed to wear and tear, sometimes even violence, throughout life just as the back is. The back and the foot are the parts of the body which are most often strained and damaged because of the great demands put on them. They are built so as to fulfil these demands, and they are able to do so, but only if they are given proper conditions of development during growth and if they are preserved in good state throughout life. If the foot does not obtain sufficient strength, the arches will not be reliable; they give, are pressed down, and the pains and trouble accompanying flat foot will appear (Fig. 42).

FIG. 42.—Flat foot.

The arches of the foot are kept up partly by ligaments and partly by muscles. Ligaments alone are not sufficient; they would give and stretch. Here as in other parts of the body where a position has to be kept against constant pressure or pull, muscles are necessary. They are the more needed in the foot as its arches have to be resilient, and this elasticity is made possible by muscles, not by inextensible ligaments. Big and strong muscles are required for this; there is not room for them in the foot itself; they are found in the calf and act on the foot through long tendons. Some of the muscles send their tendons behind and under the inner ankle, others behind and under the outer ankle to the under surface of the foot. By their pull they tighten the arch of the foot just as an iron band may help to keep up the vaulted roof in a church. They give the foot a graceful shape, the instep will be high, showing that the arch of the foot is kept well up. The ability of the foot to act like a spring is now increased so that the "beautiful and the good" are here fused. If the arch sinks and flat foot becomes the result, the foot will be painful in walking and like a log, not like a spring.

As the tendons of these muscles pass down the sides of the ankle they help to protect the foot against big and violent sideways movements, as those causing sprained ankle.

The exercises developing these muscles, so important to the foot, are all exercises performed on the toes from the simplest heel raising to skip jump, skipping, running on the toes, dancing and jumping exercises in which the calf muscles must act strongly both in the take off and in the landing.

Skip jumps are pronounced rhythmical exercises; they are excellent in training the sense of time, especially when done to singing or music.

A. Foot Closing

1. **Standing, Foot Closing (Close Standing Position).** *Feet—close!* While the balls of the feet are for a moment lifted slightly from the ground, the feet are turned on the heels, straight forward, so that their inner edges touch from heel to toe.

Feet—open! The feet are turned back to the erect position in the same way.

Foot closing and opening is often taken on one command. *Feet close and feet—open!* and it is then chiefly taken to correct the angle of the feet. On the command *Feet full—open!* the feet are turned out to form a right angle. This position is used, for instance, for lunging outward.

B. Foot Placings

Foot placings give good starting positions for many exercises they are, in addition, excellent exercises for time and also good preparatory exercises for marching as they introduce the correct movement of the legs, especially with regard to the stretching of the ankles and knees.

2. (*a*) **Wing Standing, Foot Placing Sideways (Wing Stride Standing Position).** *Left foot sideways—place!* The left foot is moved two foot-lengths straight to the side and put on the ground with the toes down first; the angle of the foot as in the erect position. The weight of the body moves with the foot so that it comes to rest equally on both legs.

Left foot inward—place ! The ball of the left foot pushes off strongly to move the body over on to the right foot. The right knee must be kept stretched and the body must not sway.

(*b*) **Wing Standing, Foot Placing Astride (Wing Stride Standing Position).** *Feet astride—place !* The left foot is moved quickly a foot-length to the left and immediately afterwards the right foot a foot-length to the right. The foot angle as in the erect position. The body must not be moved with the feet but be kept still ; different to (*a*), where the body moves with the foot and where the time therefore is slower.

Feet together—place ! The left foot is moved first and then the right.

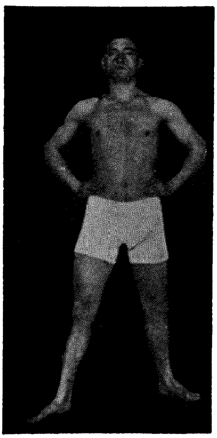


FIG. 43.

Stride position may also be taken by a jump.

Stride position is the best starting position, especially for some of the most important trunk exercises such as side bendings, trunk bendings backward, forward, and downward, and trunk turnings. The firmness of the position enables one to swing, bend, and twist the trunk forcibly and quickly and to go to the extreme limit in all movements.

3. **Wing Standing, Foot Placing Outward (Wing Walk Outward Stand Position).** *Left Foot outward—place !* The left foot is moved 2 foot-lengths obliquely forward in its own direction, and is put on the ground with the toe down first ; the knee is slightly bent while the foot is lifted from the ground, and well stretched when the foot is put down. The weight of the body must follow the movement, so that it comes to rest equally on both legs (Fig. 43).

(*Left foot*) *inward* (or *recover*)*—place !* Taken as foot recovery in 2 (*a*).

4. **Wing Standing, Foot Placing Forward (Wing Walk Forward Standing Position).** *Left foot forward—place !* The left foot is moved 2 foot-lengths straight forward, with the original angle kept exactly, and is placed on the ground with the toes down first ; the knee is slightly bent as the foot is lifted from the ground and well stretched as the foot is put on the ground. The weight of the body goes with the

movement, so that it comes to rest equally on both legs.

(*Left foot*) *inward* (or *recover*)—*place !* Performed as foot recovery in 2 (*a*).

Foot placings may be combined with arm movements (especially arm stretchings, raisings, swingings, and flingings) and with various forms of other leg movements such as heel raisings and knee bendings. They are generally good exercises for training the sense of time.

C. Lungings

Lungings are among the most beautiful and plastic of the free standing exercises, and ought, if only for the sake of their beauty, to be much practised. They are, besides this, especially strong leg exercises (knee bendings) which strengthen the muscles of the legs and make the joints supple. This is especially the case when a very long step is taken and the joints of the forward leg are bent as much as possible; the teacher therefore should not omit to use such long lungings now and then, when the pupils are accustomed to lungings of the ordinary length. If lunging is combined with trunk turning the exercise becomes, in addition, a dorsal or a lateral exercise, according to whether the turning is done to the side of the forward foot or to the opposite side. Lunging forward is always a dorsal exercise as well as a leg exercise.

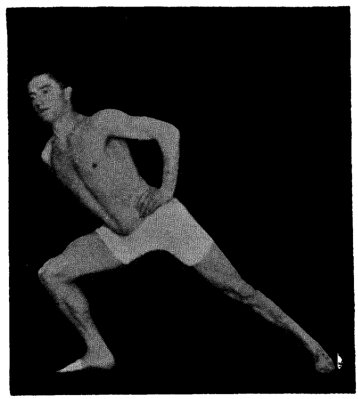


FIG. 44.—Lunging outward.

5. **Wing Standing, Lunging Outward (Wing Lunge-Outward Standing Position).** *Left foot lunge outward—place !* The body is set falling outward and the left foot is moved out with a slight bending in the knee 3 foot-lengths in its own direction, and is put lightly on the ground with the toes touching first. The knee is bent so much that it comes over the toes and is somewhat pressed outward; the lower part of the forward leg and the back leg are about parallel. The back leg and the body are held exactly in continuation of one another

and quite stretched during the whole movement, the sole of the back foot firmly against the ground, head and shoulders relatively as in the erect position (Fig. 44).

(*Left foot*) *inward* (or *recover*)—*place !* With a strong stretching of the left hip, knee and ankle-joint the weight of the body is transferred on to the rear leg, which is kept absolutely straight, and the left foot is brought firmly up to the right.

Lunging may be practised rhythmically by taking several lunges one after the other with the same foot, or by lunging alternately to the left and right. In the latter case the exercise may be taken on the same spot or advancing forward in zigzag.

In the lunge outward standing position one may practise takings off with the moved foot by a stretching of ankle, knee and hip joint sufficiently powerful to make the body swing somewhat upward and the foot leave the floor. In the return movement the knee should be bent well as this gives powerful exercise for the extensors of the knee. The exercise is taken first in individual rhythm and fairly slowly so as to allow a full bending of the knee; later it is taken in joint-rhythm, *e.g.*, with 3 or 4 takings-off before the change of feet. If the time is not hurried the rhythm in this exercise may be quite pleasing.

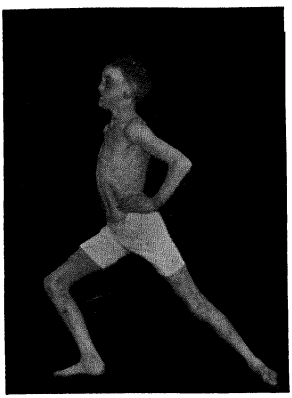


FIG. 45.—Lunging outward showing common faults.

Introduction. As lunging is a fairly combined and difficult exercise it is introduced by taking first foot placing and from this knee bending. The teacher commands: *Lunging outward in 3 movements* (*by numbers*)—1—2—3. On 1, a long foot placing outward is taken either by moving the foot 3 foot-lengths obliquely forward or by moving the one foot $1\frac{1}{2}$ foot-lengths obliquely forward and the other foot the same distance obliquely backward, which is easier (compare foot-placing astride). On 2, the forward knee is bent while the body is inclined outward in straight line with the rear leg; on 3, the forward leg is stretched so strongly that the whole body is brought back to the erect position. The second movement, the most important part of the exercise, can be repeated several times (*Knee—bend! Knee—stretch!*) before returning to the starting position. It also makes it easier for beginners if they are given the lunging after taking a half-turn as the exercise then can more easily be done correctly by the pupils and can be corrected better by the teacher.

Common Faults—Forward Leg. (*a*) The step is too short and in the wrong direction.

(*b*) The forward knee is bent too little and falls inward (Fig. 45).

Rear Leg. (*c*) The rear foot turns over on to the inner edge or is turned too far outward because the heel is drawn forward (Fig. 45).

(*d*) The rear knee is bent during the movement to and from the position, and is kept bent in the position (Fig. 45).

Trunk. (*e*) The trunk is held back during the movement out to the position.

(*f*) The trunk is twisted, held too upright (Fig. 45), or is inclined too far to the side or forward.

(*g*) The trunk is swayed backward when the front foot is to be moved back.

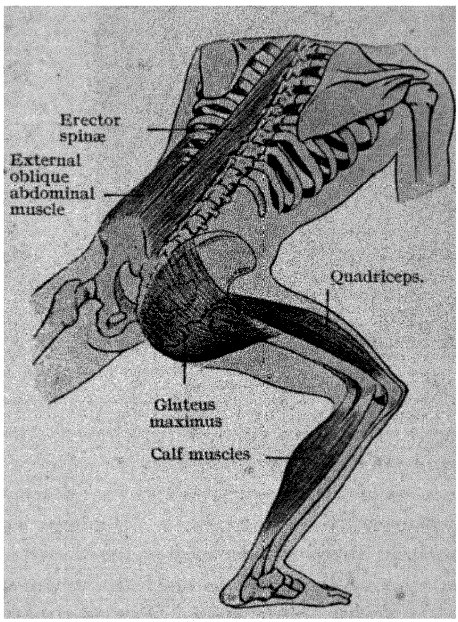


FIG. 46.

Muscle Work (Fig. 46). Gravity will bend the ankle, knee, and hip joints in the forward leg; this is prevented by the *calf muscles*, the *quadriceps*, and the *gluteus maximus* respectively, all working eccentrically in lengthened condition. The knee, which has a tendency to be drawn inward by the adductors, is kept abducted by the *gluteus maximus*, *medius* and *minimus*. The trunk, which gravity will bend outward, is supported by the muscles of the upper side, the *external and internal oblique abdominal muscles* and the *erector spinæ*, all working statically. If a trunk turning is taken to the side of the forward foot the trunk is held only by the *erector spinæ*. If, on the other hand, the turning is taken to the side of the standing foot, the body is held by the lateral muscles of the upper side.

6. **Wing Standing, Lunging Forward (Wing Lunge Forward Standing Position)** (Fig. 47). *Left foot lunge forward —place!* The body is set falling forward, the left foot is moved 3 foot-lengths straight forward, turned out at exactly the same angle as in the erect position. Otherwise as in lunging outward.

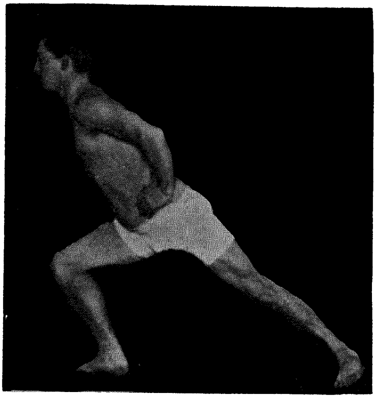


FIG. 47.

Left foot inward (or *recover*) —*place!* Taken as foot recovery in 5.

Lunging forward may be taken rhythmically like lunging outward and with take-off as described under 5.

Introduction. Lunging forward can be introduced in 3 movements in the same way as lunging outward.

Common Faults. As given in 5; in addition: (*a*) The forward foot is turned too much forward, which causes the whole body to be turned to the side of the rear foot.

(*b*) The rear heel is lifted or drawn forward.

Muscle Work. As far as the legs are concerned the muscle work in lunging forward is practically the same as in lunging outward. The trunk is held up by the *erector spinæ*.

7. **Wing Standing, Toe Lunging Backward (Wing Front Lunge Toe Support Standing Position).** *With toe support left foot lunge backward—place!* The right knee is bent outwards to an angle of not more than 90 degrees, the left leg with knee and ankle stretched is carried backwards, and the toe rested lightly on the ground 3½ to 4 foot-lengths behind the other foot. As the leg moves backwards the body is kept in line with the leg and comes to a position inclined forward over the bent knee. The weight of the body must rest fully on the front leg so that the rear foot may be lifted

from the ground without the position otherwise being altered.

Foot Changing—1—2. On 1 the left foot recovers while the trunk is being raised so that the leg and the body are kept in line. On 2 the right foot is placed back as described above.

Stand—erect !

Introduction. The position is difficult, and it is best introduced with support of the hands on wall bars or beam about knee level; also bench or stool may be used. When the position has been reached the hands may leave the apparatus and be placed on the hips, the body being kept in line with the rear leg. The hands may also take support on the ground as the leg is moved backwards. The trunk, which is now slightly stooping, must then be raised to the inclined position, when the hands are put in the wing, bend, or yard position.

Common Faults. Rear Leg. (*a*) The foot not placed far enough back.

(*b*) The knee is not fully stretched.

(*c*) The instep is not stretched.

(*d*) The rear foot turned outward and supported on its inner edge instead of on the toe.

Forward Leg. (*e*) The knee insufficiently bent.

(*f*) The foot is turned forward and the knee falls inward.

The Trunk. (*g*) The trunk held too vertical by a bending backward.

(*h*) The trunk is inclined too much forward by a bending at the hips. This is particularly found when the forward knee is bent too little and not kept outward.

8. **Wing Standing, Lunging Sideways.** *Left foot lunge sideways—place !* The body is set falling towards the left, the foot is moved 3 foot-lengths straight to the side, the knee kept stretched, and then put lightly on the ground with the toes touching first. The knee is now bent to at least an angle of 90 degrees and moved well outwards. The trunk is kept vertical, shoulders therefore level, and the chest facing forward. Right knee straight and the sole of the foot firmly on the ground.

Left foot inward (or *recover*)*—place !* Performed as the recovery in 5.

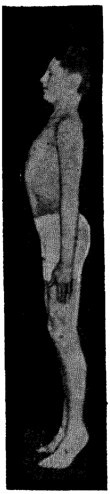
The exercise may be done rhythmically as in lunging outward, 5. The arms may be moved from wing or erect position to yard position in the lunge.

Common Faults. As in 5 (*a*)-(*d*); furthermore, the trunk may be inclined forward.

Muscle Work. As regards the legs the muscle work is practically the same as in lunging outward. The adductors of the straight leg will be stretched considerably, which may tend to correct milder cases of knock-knee.

D. Heel Raisings

The strong stretching of the body is the most valuable part of heel raisings, as it takes into use the most important extensor muscles of the body. When the carriage is getting slack it may be of greater effect to command a heel raising than to demand a general "stretch-up."



IG. 48.

Heel raising, like other exercises performed on the toes (standing, jumping upward with straight knees, hopping, dancing steps etc.) has a beneficial effect on the foot by making the instep high, *i.e.*, strengthening the muscles and ligaments supporting the arch of the foot. During walking and similar movements an arched foot acts like a spring while a foot with a sunk arch, a flat foot, is like a log.

9. **Standing, Heel Raising (Toe Standing Position).** *Heels—raise!* The heels are kept together and raised as high as possible. The body is strongly stretched, the head moved a little backward, so that the whole body is in a slightly overstretched erect position (Fig. 48).

Heels—lower! The heels are lowered lightly to the ground again.—Introduced with support.—May be done in time and combined with arm movements, *e.g.*, bend standing, arm stretching sideways and upward.

Common Faults. (*a*) The balance is not steady, trunk and head are bent forward, so that the stretching is lost.

(*b*) The heels are parted, not raised high enough, and lowered too heavily.

(*c*) The knees are not kept fully stretched.

10. The forms of heel raising most used besides the one given above are taken from: **Wing Standing, Stretch Standing, Wing Stride Standing.**

E. Knee Bendings

Knee bendings are in themselves some of the best of the leg exercises, as they strengthen the leg muscles, especially the extensors of the knee, and make the joints of the legs supple; this, of course, applies specially to deep knee bendings, which, if taken regularly throughout life, are among the best exercises for keeping the joints of the legs, particularly the knee-joints, in order. They are, besides, among the best depleting exercises. The strong pressing out of the knees in the knee bendings has a corrective effect on the less pronounced forms of knock-knee, as the adductors of the thigh, which in this case are too short, are stretched. Knee bendings are, in addition, good preparatory exercises for jumping, both for the take-off and especially for landings, where the knees have to yield quickly and just as quickly be stretched again, and where it is of special importance, both in order to stand steady and to be able to keep the trunk vertical that the angle of the feet should be large and the knees pressed well outward.

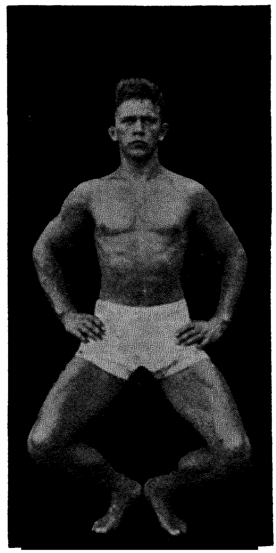


FIG. 49.

11. **Wing Standing, Heel Raising and Knee Bending (Wing Spring Standing Position).** *Heels—raise! Knees—bend!* The knees are bent smoothly until there is a right-angle at the knee-joint, and at the same time are pressed well out. The trunk must, during this movement, retain its vertical position and the strong stretching which it had in the heel raising (Fig. 49).

Knees—stretch! The knees are smoothly stretched fully out without the trunk being moved or losing its vertical position. *Heels—lower!*

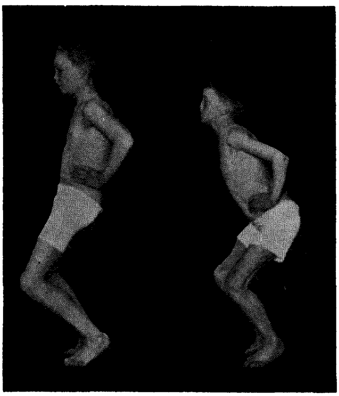
After the pupils have had some practice the teacher can command: *Heel raising and knee bending*—1—2—3—4. If the exercise is to be done in time, the command is: (*In time*) *Heel raising and knee bending—begin! Halt!*

The exercise may be done in two ways, slowly while being introduced, and quickly later on.

For beginners and children the exercise will also be a balance exercise as the heel raising diminishes the supporting area, but this only adds to its value.

Knee bending may be taken without heel raising in standing, and especially in stride standing position. The degree of bending then depends on the mobility of the ankle-joint. During the greatest possible knee bending with the heels firmly on the ground the muscles at the back of the leg will be strongly stretched and the ankle-joints made flexible.

The knee bendings most commonly used during a gymnastic lesson, and those demanding the greatest work of the extensors of the knee, are the landings after jumps and vaults. Besides carrying the weight of the body the extensor muscles have to break the fall. To this may be added that the knee bendings during landings are balance exercises in a far more marked degree than other knee bendings. A landing may therefore be looked upon not only as the close of a jump but as an exercise of great value in itself.



FIGS. 50 and 51.—Heel raising and knee bending, showing common faults.

Introduction. In order to introduce the correct form of knee bending as quickly as possible, it is at first taken with support against a wall bar or a beam. The name of the exercise is then: **Support Standing, Heel Raising and Knee Bending.** The side is turned to the apparatus, and the one hand supported at hip height. The command is: *Left side towards, to the wall bars (beam)—run! Right hand on hip, left hand hip height—grasp! (left hand beam—grasp!)* After the knee bending the hands are brought to the erect position on the command: *Hands—down!*

Common Faults. (*a*) The heels are parted.

(*b*) The angle between the feet is too small.

(*c*) The knees are not pressed enough outwards (Figs 50 and 51).

(*d*) The trunk is inclined forward (Fig. 51) or backward (Fig. 50) and the chin is poked forward; the back is rounded (Fig. 50).

(*e*) The knees are not fully stretched in the knee stretching.

The reason that the body loses its stretching is that the pelvis during the bending in the hip-joint is apt to tilt forward, so that its inclination is diminished ; this causes the loin to be pushed out and the back rounded. The more the knees are held out in the knee bending the easier it is to keep the pelvis and thus the back in the correct position. But the knees cannot be pressed out unless the feet are turned enough outward ; the reason is that the ankle-joint is a hinge-joint, and the knees therefore go in the direction in which the feet point. The teacher therefore must see that the angle of the feet is correct before the knee bending is taken.

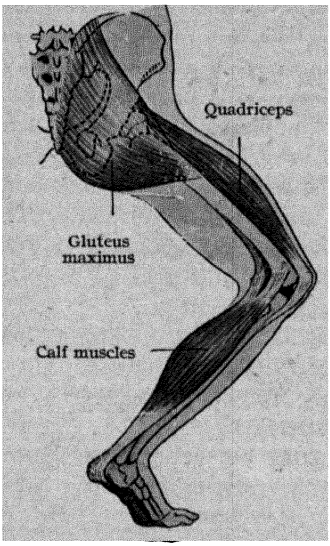


FIG. 52.

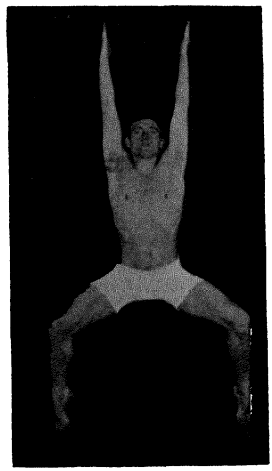


FIG. 53.

Muscle Work (Fig. 52). The heel raising is done by the *calf muscles*. The knees are bent by the weight of the body, while the *quadriceps* resists, working excentrically. The knees are kept out by the *gluteus medius* and *minimus* under resistance from the *adductors*, which are stretched (especially where there are knock-knees). The hip-joint is also bent by the weight of the body ; the *extensors of the hip*, especially the *gluteus maximus*, must then resist. The same muscles which work excentrically in the knee bending work concentrically in the knee stretching.

12. The forms of knee bendings most used besides those already given are from : **Wing Stride Standing** ; **Stretch Stride Standing** (Fig. 53) ; and **Stretch Standing**.

13. Wing Standing, Heel Raising and Full Knee Bending (Wing Spring Sitting Position) (Fig. 54). *Heels—raise! Knees full—bend! Knees—stretch! Heels—lower!* or *Heel raising and knee full bending*—1—2—3—4; or *Go! Halt!* Taken as described in 11, but the knees are bent as much as possible. The exercise can also be taken with the arms in rest or stretch position. Full knee bending, like knee bending, is sometimes taken quickly (see 11).

As a preparation for landing, full knee bending should be taken in 3 movements. The command then is: *Heel raising and knee full bending quickly in 3 movements*—1—2—3. On 1 the heels are raised; on 2 the knee bending and stretching are taken as quickly after one another as possible; on 3 the heels are lowered. The second movements can be repeated several times without the lowering of the heels.

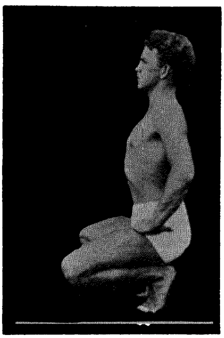


FIG. 54.

In spring sitting position little bobbing movements may be performed. They have a marked influence on the mobility of the knee-joints and also to a certain extent on the ankle-joints.

Introduction. Support is used at first; it is more difficult here than in ordinary knee bending to keep the body both straight and vertical.

14. Changing between Four Standing (Crouch Sitting) and Stride Standing Position with a Jump. *On fours—down! In stride standing—up!* The knees are stretched quickly and with a jump the feet are placed in stride position. On *down!* the feet are brought together with a jump to four standing position.

The exercise may be done in time. After some practice (wing) spring sitting position may be used instead of four standing, and during the knee stretching the arms may be moved to yard position.

The exercise makes the hip-joints flexible by stretching the adductors of the thigh.

15. (*a*) Four Standing, Alternate Foot Placing Sideways. *On fours—down!* The palms of the hands are placed on the floor close to the feet, so that the weight of the body may be partly carried by them during the foot placing. *Alternate foot placing sideways*—1—2—3—4. On 1 the left foot is placed straight to the side, inner edge of the foot resting on the floor, leg stretched. On 2 the foot recovers. On 3 and 4 corresponding movements are performed with the right foot.

After some practice the feet may be changed in one movement with a jump, during which the weight of the body for a moment is fully supported on the hands. This change is first taken by numbers, later rhythmically.

(*b*) **Four Standing, Double Foot Placing Sideways.** From four standing position the command is: *Double foot placing sideways*—1—2. On 1 both feet are moved with a jump sideways, simultaneously as far as possible, knee fully stretched. The weight of the body is momentarily carried by the hands. On 2 the starting position is resumed. The exercise is taken first by numbers, later rhythmically.

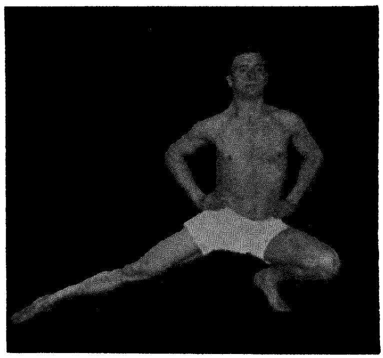


Fig. 55.—Alternate full knee bending.

The effect of this exercise on the hip-joints and the adductors of the thigh is still greater than that of the former exercise.

16. (*a*) **(Wing) Stride Standing, Alternate Knee Bending.** *With long steps, feet astride—place!* Each foot must be moved at least 1½ foot-lengths, so that the distance between the feet will not be less than 3 foot lengths. *Alternate knee bending, to the left* 1 2; *to the right*—3—4. The trunk is kept vertical during the knee bending, and the knee moved well outwards. The arms may be carried to yard position during the knee bending, and to wing or erect position during the stretching.

The exercise may also be done in two movements. On 1 the left knee is bent, on 2 it is stretched, and immediately afterwards the right knee is bent. Performed like that, it may be done rhythmically with a wave-like motion, one movement gliding into the other.

Beginners may practise with the hands grasping a beam or a wall bar at hip level (the hands sliding along the apparatus from side to side during the movements), or in couples with the hands joined (ring grasp) or in ranks with chain grasp.

(*b*) **(Wing) Stride Standing, Alternate Full Knee Bending** (Fig. 55). *Alternate full knee bending, to the left*—1—2 ; *to the right*—3—4. Here, also, the body must be kept vertical. During the knee bending the arms may be moved to yard position or to half ear and half yard position with a head turning towards the stretched leg ; left arm is carried to yard position when the left leg is stretched, and vice versa. It is a powerful exercise for the extensors of the knee that have to work to and from the greatest lengthening, and the adductors of the thigh will be strongly stretched. The balance difficulty is marked, which makes the exercise valuable too.

It may be done in two movements, the bending of the one knee beginning as soon as the stretching of the other has been completed, and one movement gliding into the other without any stopping. The exercise is too difficult to be taken rhythmically for other than well-trained pupils.

FIG. 56.

17. **Support Kick Standing, Full Knee Bending.** After support has been taken the command is: *Left leg forward — raise ! Right knee full—bend ! Knee—stretch ! Feet—change !* and so on. The knee is bent as much as possible without the heel being raised. This demands a big bending of the ankle ; flexibility of the ankle-joint is thus improved, which is often needed. The back is kept straight and as near the vertical as the position allows. Both hands may grasp a beam at hip level, and the arms may then help in the knee stretching if need be. Later the hands simply touch the lower edge of the beam to minimise the balance difficulty. Support may also be taken with the side towards the wall bars, one hand grasping a bar at hip level and so far forward that the arms will be almost in reach position during the bending. Living support may also be used, either chain grasp support where the ones stand facing the spaces between the twos, and vice versa, or ring grasp in pairs (Fig. 56).

In the support kick spring sitting position one may practise leg changing. With a give in the bent knee and a jump the legs are changed either by numbers or in time.

Exercises involving bendings of one knee are the most powerful exercises in the group leg exercises. The muscles working are first and foremost the extensors of the knee, then the muscles of the calf and the extensors of the hip-joint. They will be developed and lengthened during the exercises as they are working excentrically from a marked shortened to a strongly lengthened position, and conversely (concentrically). The knee-joint is moved from one extreme to the other, from the stretching in the erect position to the extreme bending in the spring sitting position. By that this very complicated and exposed joint will be made mobile and strong. The ankle-joint is only moved to one of its limits, the limit for flexion (dorsal flexion); but it is made particularly strong as it has to carry the weight of the whole body. The calf muscles arising from the bones of the lower leg will be strongly stretched. These exercises may therefore be reckoned among the tension exercises for the calf.

A diligent use should be made of these exercises. No teacher must feel satisfied with the physical development of his pupils till they are able to raise and lower the weights of their bodies on one knee with ease. And no-one should omit to practise knee bendings, both with one and with both knees, during advancing years; he will find by keeping in training that he will be able to go on up to a far more advanced age than most people believe. There are many, particularly women, who omit to preserve the strength of their leg muscles and the mobility of the three main leg joints, with the result that already at the age of 50 they cannot manage a full bending of their knees. The efficiency of their legs is thus lowered, they feel it more difficult and less pleasing to take the exercise necessary for their health. This exercise is procured first and foremost by the using of the legs, particularly so as one grows older.

Knee bendings may be combined with arm movements in various ways.

F. Astride and Skip Jump, Hopping and Dancing Steps

Skip jump, astride jump, hopping and dancing steps form the transition between leg exercises and jumping. Previously they were classed among jumping exercises, but as they are justly used at the end of the introductory exercises (Section A of the table) there is good reason to class them with leg exercises.

They consist of quick heel raisings which are performed with so much vigour that they, together with a "give" (a slight bending and stretching) in the knee and hip-joints, lift the body from the ground in a little jump. They demand vigorous work on the part of the calf muscles and help in that way to develop them so that they may act like strong springs making the movements of walking, running, dancing, etc., light and elastic.

They are good as introductory exercises for landings by training the calf muscles in the yielding necessary for light landings. Heavy landings are often just as much due to tense and unyielding calf muscles (stiff ankles) as to tense muscles at knees and hips.

As mentioned under heel raising (p. 152), these exercises give the foot a good form with a high instep and a strong arch. As the tendons from some of the calf muscles pass down on both sides of the ankle to the sole of the foot the exercises will also strengthen the ankle, and thereby guard against sprained and twisted ankles.

They are fatiguing exercises with a marked effect on the breathing and the heart action; they should therefore not be taken immediately after other fatiguing exercises, but may suitably be taken at the end of the introductory exercises.

They are to a marked degree rhythmical exercises. If taken to music they may develop the sense of time.

They are found in many forms and combinations, of which only a few are mentioned here.

18. **Standing, Skip Jump.** *Skip jump—begin! Halt!* The jumps are made with big movements of the ankles. The calf muscles must not be so tense that the ankles become "stiff." The heels should almost reach the floor in the landing, otherwise the jumps will not be light and elastic. There is a slight and rapid yielding at knees and hips. The back is kept straight, the head lifted high as in heel raising.

In the infant class each child should be allowed to take the exercise in the time natural to him. To make the jumps high enough the time should never be too quick. The jumps may be taken moving forward, backward, sideways, or with turnings and about turnings (a high jump when turning). The exercise may be taken to a given number, for example, 10, finishing with a high jump and landing on all fours ; this may also be combined with turns. An arm turning outward may be taken on every other jump. This arm turning, during which the arms are moved a little away from the body, encourages erect carriage.—Arm bending with a gentle arm stretching sideways and slightly downward, palm turned upward, may also be added. If correctly taken, these arm movements go well with the rhythm of the jumps and help to give good carriage of shoulders and head.

19. **Walk Standing, Skip Jump with Foot Changing.** After the one foot has been placed forward the command is : *Skip jump with foot changing—begin ! Halt !* The jumps must be fairly high, therefore a bigger yielding in the knees than in ordinary skip jump. The feet pass one another closely and are turned slightly outward. The landings light and springy.

20. **Astride Jump.** *Astride jumping—begin ! Halt !* Taken as skip jump, alighting with the feet astride and together alternately. The toes must not be turned in when the feet are astride. *Halt !* falls when the feet are together, after which a jump is taken with the feet apart, then together with a heel lowering.

The arms may be in the erect position or wing position ; the exercise may be combined with arm swinging sideways or sideways-upward ; in the latter case hand clapping above the head may be added. During the arm swingings the arms must be carried well back and the head lifted. May also be taken with a crossing of the feet.

21. **Standing, Hopping with Leg Swinging Sideways with or without a Rebound.** *Hopping with leg swinging sideways and a rebound—begin ! Halt !* While one leg swings sideways a hop is taken on the other foot apart from the hop in changing feet. The swinging leg must be carried straight to the side, rather slightly backward to ensure erect carriage.

When the exercise is taken without the rebound, a more difficult form, one rests as long on the foot as the rebound would have taken. There should now be a slightly bigger yielding in the knee and hip-joints. The leg is carried well back in the swing, the trunk erect. May also be done with toe support sideways ; this requires a deeper knee bending than before.

22. **Standing, Hopping with Leg Swinging Forward with or without a Rebound.** *Hopping with leg swinging*

forward and a rebound—begin! Halt! As before, but with the leg swinging forward. Knee and instep on the swinging leg stretched, the foot turned slightly outward. Body erect. During the change the heels pass one another closely.

If taken without a rebound one rests a moment on the foot, as before.

This latter may also be done with toe support forward. The stationary knee must then be bent a little more than before.

23. **Hopping with Knee Raising and a Rebound.** *Hopping with knee raising and a rebound—begin! Halt!* In the hop the knee is raised till the thigh is horizontal without any bending of the supporting knee and without bending the trunk forward. May be combined with alternate arm swinging forward, right arm swinging forward while the left knee is raised, and vice versa.

It may also be taken with toe support sideways or forward. The toe is pointed sideways or forward as the feet are changed, and the knee is lifted in the rebound.

24. **Reel Step.** *Reel step—begin! Halt!* Reel step is a hop on one foot and a rebound during which the free foot is lifted, carried behind and placed on the floor close to the heel of the other foot, but on its far side. In the rebound the foot is placed forward a little, so that the exercise throughout is taken on the same spot. Done in quick time.

May also be taken with 1, 2 or 3 hops during which the free leg is swung in a rather big curve sideways and backwards before the foot is placed on the floor at the far side of the supporting foot. The time should be somewhat slower than in the previous step.

G. Game-like Leg Exercises

The exercises with full knee bendings are very strong leg exercises; children, however, are often more in training than adults, especially as regards the legs, and they can with surprising ease go down to the spring sitting position and remain in it for a long time. These knee bendings, therefore, can and should be taken quite early with normally developed children.

25. **Four Standing Position (Crouching Position).** *On fours—down!* (or *Crouching position—place!*). *Up!* On *Down!* the knees are fully bent, the hands placed on the floor just in front of the feet, which at first should be apart, the arms

between the knees. (The feet can be moved sideways with a little jump during the knee bending, and during the stretching they can be brought together again in the same way.) When the feet are kept together in the crouching position they can be moved to stride position during the knee stretching at the same time as the arms are brought out to yard position ("as broad as a road") or to stretch position ("as big as a house, as small as a mouse").

26. **Stamping the Floor in Time.** *Stamping the floor with the left foot—begin!* The teacher points out which foot to stamp with. By distinct counting he endeavours to make the children keep time. Same time as in quick walking. *Halt! Now the other foot—begin! Halt!* The main object is to teach the children to keep in time.

When the children are able to keep time with one foot, they are trained to stamp alternately with both feet as in marching on the spot with stamping. The children may also clap their hands or sing to the exercise.

27. **Marching on the Spot with a Slight Knee Raising.** *With a slight knee-raising marching on the spot—go! Halt!* The steps are light but taken distinctly in time (the teacher counting). The knees are raised in a quick movement, almost a jerk.—The children may count aloud to 10 and on 10 quickly go down in the crouching position. On *go!* they get up quickly and perform another 10 steps, and so on.

28. **Running on the Spot with a Slight Knee Raising.** *With a slight knee raising running on the spot—go! Halt!* Light and springy movements on the toes, keeping definite time. Also here the exercise may be interrupted by a knee bending to crouching position as in the previous exercise.

29. **Running on the Spot with Heel Swinging Backward-Upward.** *With heel swinging backward-upward running on the spot—go! Halt!* By a quick bending of the knees the heels are alternately swung backward-upward so as to touch the seat. The steps must be light without any dragging of the feet in the take-off. The exercise—like a great number of our exercises—is very old. The ancient Greeks used it; they called it *bibasis*, derived from a word meaning walking, dancing.

As with the exercises in 27 and 28 it may be interrupted by crouching.

Older children may do the exercise with the feet kept together. After a vigorous take-off and during a high jump both heels are swung backward-upward. The landings must be springy without any stiffness in knee- and hip-joints. The exercise is fatiguing, so only a few jumps should be attempted at a time.

30. Cross Sitting Position (Cross-Legged Sitting). *With crossed legs—down! Up!* The legs are crossed by one foot (alternate left and right) being put in front of the other, then sitting position is taken with the legs well drawn in and the back straight (Fig. 57). To get up, the children at first push off from the floor with their hands, later the arms are raised forward; it is the most difficult to rise with the arms folded and steady. By degrees they must be able to stretch the knees so strongly that the rising ends with a little jump, during which the crossed legs return to the erect position.

Little children spring up and down quickly in free form.

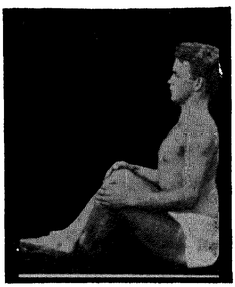


FIG. 57.

In the cross-legged sitting position the children may grasp the feet and practise rolling backward and forward ("the rocking chair"). The back is rounded and the children roll back till the body is resting on the shoulder-blades and the back of the head. After that they roll forward again without pausing. To make the rolling go quickly the trunk is bent forward a little before the start. To begin with they only roll once on the command *go!* Stress is then laid on an erect posture in the cross-legged sitting position. In that way the children learn to work strongly with the dorsal extensors while the extensors of the lumbar region are kept inactive. The children must necessarily learn this localising of the muscular work in order to take up and acquire a good erect posture.

When the exercise has been mastered in this way it may be taken freely with several rollings in succession.

When the word *Halt!* is given a full stretching of the back must be insisted upon.

After some practice the children may roll right over, both backwards and forwards, in a somersault; quite a useful exercise, forming for little children an introduction to the so-called agility exercises. A certain amount of physical courage and agility is necessary when the children have to perform this exercise on the bare floor without hurting themselves.

31. **Crow Walk (Spring Sitting, Walking Forward).** In the walking the body must be moved up and down a little by a spring in the joints of the legs. This can be taken either in rank arrangement with chain grasp (easier), or in file arrangement with grasping of the hips or shoulders of the one in front.

32. **Crow Hopping (Spring Sitting, Jumping Forward).** There is also here a strong springing in the legs. The same arrangement as in crow walk.

Crow walk and crow hopping are very effective exercises for children and adults alike.

§ 15. Arm Exercises

Introduction

The exercises in which the legs are doing the main work are not arranged under one group, but under four: leg exercises, balance exercises, marching and running, jumping and vaulting. This has been found natural. But the same holds good for the exercises in which the arms are chiefly used, when we divide them into two groups: *arm exercises* and *heaving exercises.* There is the more reason for this division as there are considerable differences between them as regards their effects.

In arm exercises the shoulder is the fixed part and the hand is moved. In heaving exercises the hand is the fixed point for the movement, whereas the shoulder is moved.

In arm exercises the arms and shoulder muscles carry the weight of the arms only. In heaving exercises the same muscles carry the whole or part weight of the body.

In arm exercises the extensor muscles are principally working (the extensors of the arms, the deltoid, the outward rotators of the shoulder-blade). In heaving exercises (with the exception of stretch hanging exercises) the flexor muscles chiefly are doing the work (the flexors of the arms, the pectorals, latissimus dorsi, the inward rotators of the shoulder-blade, and in climbing, upward circling and similar exercises, also the abdominal muscles, which are flexors too, and the flexors of the hips.)

Arm exercises are mostly quick exercises making for agility and control of the arms, good co-ordination, especially the complicated forms. Heaving exercises are generally slow exercises of easy co-ordination.

Arm exercises are easy and develop mobility. Heaving exercises develop strength.

Arm exercises are all free standing exercises. Heaving exercises are all performed on apparatus.

One of the principal aims of arm exercises is to secure mobility of the joints of the arms, particularly the shoulder-joint and the muscular connection between shoulder-blade and trunk. This will tend to improve the carriage of the shoulders as the muscles pulling the shoulder-blades back (rhomboids and parts of trapezius) are shortened, and those drawing the shoulder-blades forward (pectoralis major and minor) are lengthened. Through parts of the trapezius (Part II.a.) the shoulders are suspended from the lower half of the cervical spine (see p. 178). If they are drawn forward they will pull this point of suspension forward. By pulling the shoulders back, arm exercises may therefore contribute to a good carriage of head and neck and with that the upper part of the dorsal spine and the ribs. As the many strokes with the chisel form the bust of a statue, so the arm exercises form the living bust, neck and chest, and produce beauty of form.

Arm exercises are of importance in connection with the gestures accompanying speech as they may in some way express feelings and emotions. Gestures are determined by the inner life of the speaker, but they will more likely be natural and expressive when the arms have become free and devoid of stiffness and trained in many different combinations of movements demanding good co-ordination.

A. Wing and Ear Positions

Arm exercises provide various *starting positions*, especially for trunk exercises. While positions such as bend, yard and particularly stretch position serve other purposes, wing and ear positions serve the one purpose of being starting positions.

In *wing position* the aim is to fix the arms in such a way as not to hinder exercises like knee bending, trunk bending backward, etc. It is easy to take up wing position correctly; one must only remember not to press the elbows too far backward as the correct position of the shoulders will then be disturbed.

To take up a proper *ear position* is more difficult as it requires greater mobility of the shoulders than is generally found in most beginners, children as well as adults.

1. Standing, Hand Placing on Hips (Wing Standing Position). *Hips—firm!* The hands, kept close to the sides of the body, are moved quickly up to the hips and placed there with the four fingers together in front and the thumb behind. The palm rests on the hip as far as it is natural to the mobility of the wrists; it should not be pressed too hard down on the hip to prevent the position being stiff and strained. The elbows are moved as far back as is natural, while the shoulders are held drawn back and lowered (Fig. 58).

Hands—down! The thumb is brought forward to the fingers, the hands are turned and moved quickly down the sides of the thighs with the palms inward.

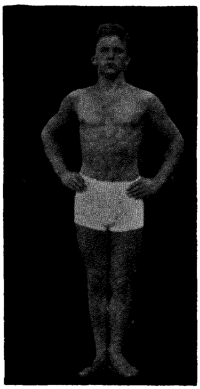


FIG. 58. — Correct position.

FIG. 59.—Faulty position.

Common Faults. (*a*) The hands grasp the hips too loosely or too tightly, and are too far forward or backward (Fig. 59).

(*b*) The elbows are held too far forward or backward. By forcing the arms back the shoulders are lifted and the shoulder blades are tilted forward to an oblique position. The shoulder sticks out in front in a lump and there is a furrow between it and the chest. The same fault may be found in bend and drag standing positions. The back is often hollowed too (Fig. 59).

To avoid these faults the hips may be grasped below the crest of the hip bone, near the level of the hip joints (*low wing position*).

2. Standing, Hand Placing on Neck (Ear Standing Position). *Neck—rest!* The hands are quickly brought the shortest way up along the sides of the body and placed on the neck, with the hands just over the junction of the head and neck, with the tips of the fingers—about the last finger-joint—interlaced or just touching one another with thumbs and fingers together. The hands and fingers must be well stretched and in continuation of the forearm without any bending in the wrists, the palms turned forward, the elbows well pressed back, the head high, the chest lifted, as it naturally will be with the arms in this position (Fig. 60).

Hands—down! The hands are moved down quickly, the shortest way by the sides of the body to the erect position.

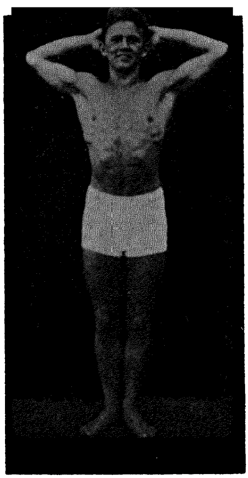


FIG. 60.

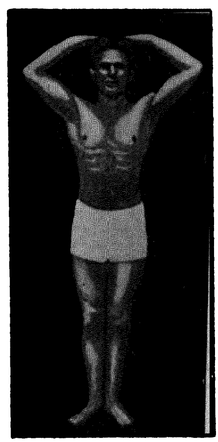


FIG. 61.

Ear position produces good posture and provides an excellent starting position for several exercises, especially trunk exercises. But the mobility of the shoulders must be such as to allow the taking up of the position easily and in good form as it will otherwise cause essential faults in the exercises.

Introduction. Before the real rest position with the hands on the neck, rest position is practised with the *hands on the crown* (high ear) (Figs. 61 and 62); the hands are then put on the top of the head with the palms downwards, which makes it easier to keep the head and elbows in the right position.

In using the ear position it must be remembered that a very fair amount of suppleness in the shoulders is necessary if it is to be taken correctly. Without this suppleness the position is ugly and gives a bad carriage of the head and upper part of the back (Fig. 63). Ear position should not be used, therefore, as a starting position if the necessary suppleness is lacking or has not been attained by means of other arm movements. At first it should be practised slowly, and can be taken with advantage from yard or stretch position or through arm raising sideways.

FIG. 62.

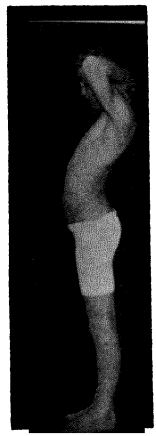


FIG. 63.

Common Faults. (*a*) The pupils bend the head forward in order to get the hands behind the neck more easily (Fig. 63).

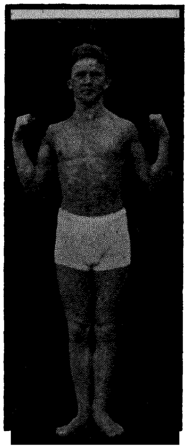
(*b*) When the head is forced back the elbows go forward, and vice versa.

(*c*) The hands are placed on the neck instead of on the back of the head.

(*d*) The loin is hollowed (Fig. 63).

B. Arm Stretchings

3. Standing, Arm Bending (Bend Standing Position). *Arms—bend!* The arms are bent quickly and strongly while the hands are moved the shortest way up along the sides of the body to the sides of the shoulders, as close in to these and as far back as possible; the wrists stretched, the hands may be clenched with the fingers towards the shoulders (Fig. 64), or slightly bent with the tips of the fingers placed on the shoulders



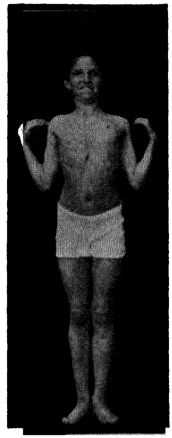


FIG. 64. FIG. 65.
Correct positions.

FIG. 66. FIG. 67.
Faulty positions.

(Fig. 65); the elbows are brought forward and close to the body, the shoulders pulled well back and down; the thumbs, elbows, and shoulders should be in the same plane.

Arms downward—stretch! The arms are stretched quickly and strongly down to the erect position without the shoulders being pulled forward.

Introduction. While it is being introduced the bend position should be taken slowly. The exercise can be introduced from lying position or from standing with the back against a wall, by means of which the correct position of the thumbs, elbows and shoulders can be controlled by the pupils.

As arm bending is an intermediate movement common to all arm stretchings, and as it is in addition especially effective for correcting bad carriage of the shoulders, it should be introduced very carefully.

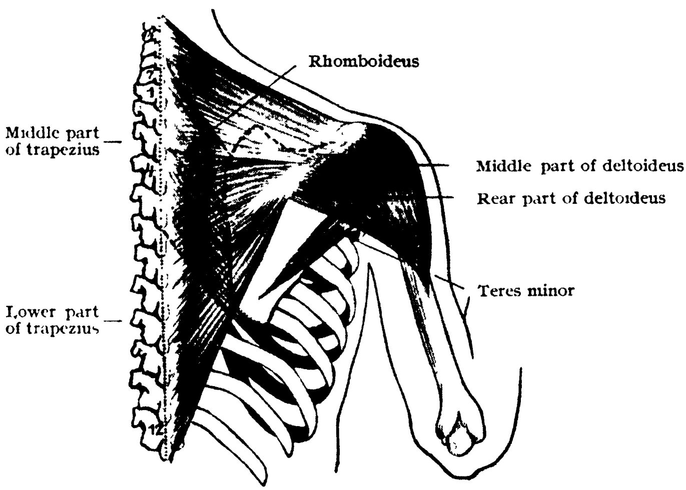


FIG. 68.

Common Faults. (*a*) The hands are held in front of the shoulders (Fig. 67).

(*b*) The elbows are brought too far back, which causes a lifting and moving forward of the shoulders (Fig. 66, compare p. 167).

(*c*) The elbows are held too far out from the sides and the shoulders are not pulled back strongly enough.

(*d*) In the effort to get the hands far back the head falls forward and the loin is hollowed (Fig. 66).

(*e*) The fingers point forward instead of towards the shoulders.

Muscle Work (Fig. 68) *and the Importance of the Exercise.* The forearm is bent to the upper arm by *biceps* and *brachialis* *internus*. The hand is moved out to the side of the shoulder partly by a rotation of the upper arm (especially by the *rear part of deltoideus*), partly because the shoulder-blades are pulled together at the back and lowered (*trapezius*, especially its horizontal part, and *rhomboideus*). This outward rotation of the upper arm, the pulling backward and lowering of the shoulders form the most important and the most form-giving part of the exercise. This stretches the horizontal part of *pectoralis major* and in some degree also *minor*. As these muscles are, in the case of many children and adults, too short, the *trapezius* and *rhomboideus* have to do considerable work in stretching them in order to get the shoulders back. In this lies the great importance of arm bending for the position of the shoulders, and through that for the carriage.

4. **Bend Standing, Arm Stretching Sideways (Yard Standing Position).** *Arms—bend! Arms sideways—stretch!* While the hands are turned and the fingers stretched so that they point out from the shoulders, the arms are stretched quickly and strongly out to the side at shoulder height and brought well back without a hollowing of the loin or lifting of the shoulders; the hands are stretched, the palms turned downward.

Arms—bend! While the palms are turned upward the arms are brought quickly and strongly into the bend position without any hollowing in the loin.

The palms can also be turned upward in arm stretching sideways; this involves an outward rotation of the upper arm of about 90 degrees; the pectoralis major is then more stretched than when the palm faces downward; in this way the chest is raised, and this form of arm stretching sideways becomes a good breathing exercise when it is taken slowly.

Common Faults. (*a*) The arms are lowered below shoulder level when they are pressed backward.

This is the most common and the worst fault in this, as in all other exercises where the arms are brought into the yard position (arm flinging, swinging and raising). The fault is particularly apt to occur when the trunk is inclined forward, as in lean standing, front lunge standing and twist oblique lunge standing position, etc.

It is especially the posture of the shoulders that suffers. When the arms are carried backwards horizontally or at a higher level the humerus comes into contact with the acromion process. The shoulder-blade must therefore move backwards with the arm, and when the shoulder-blade cannot move any further the arm must stop too. If the arm is lowered below the horizontal, even only slightly, it will not be stopped by the acromion process but glide under it. The arm may therefore be moved a good deal further back than in the horizontal position. During this movement the arm will push the shoulder-blade upwards and tilt it a little forward, so that it will get into the same oblique position as in wing position when the elbows are forced too far back (compare p. 167).

In other words, this fault will place the shoulders in the same ugly position as is often produced by daily work, a position which gymnastics should rightly counteract. To avoid the fault the arms may be brought a little above the horizontal. This is useful and effective, but the arms should not be raised too much, as in that case the special effect of yard position is lost.

(*b*) The arms are moved with a swing, both in going out to yard position and in the return movement.

(*c*) In the effort to get the arms back the head and lower part of the trunk come forward and the loin is hollowed. See paragraph 3, fault (*d*).

Muscle Work and the Importance of the Exercise. The upper arm is brought to the horizontal position by the middle part of *deltoideus*. The elbow is stretched by the *triceps*. The arm is moved backward by the *rear part of deltoideus* if at the same time *trapezius* and *rhomboideus* draw the shoulder-blades back and fix them (see Fig. 68). During the exercise there is a stretching of *pectoralis major* (especially its upper horizontal part), which muscle, when it is too short, mainly contributes to the forming of "round shoulders," which generally is accompanied by "flat chest" and round back. By this stretching of the muscle and owing to its elasticity it will pull the arm fairly strongly downwards. This is one of the reasons why the arm is so apt to go below the horizontal when moved sideways.

As the insertion of *pectoralis minor*[1] is moved well back in yard position the muscle will be stretched. When stretched

[1] *Pectoralis minor* is, according to its insertion and the direction of its fibres, perhaps the muscle that is principally causing poor posture of the shoulders, not when it has its normal length, but when it is too short, and it is often too short, and that at an early age. It will draw the shoulders forward like pectoralis major, and because of its insertion on the coracoid process near the outer and upper corner of the shoulder-blade it tilts it forward into an oblique position so that its lower angle leaves the chest

it will pull on the shoulder-blade and increase that forward tilting which always accompanies the yard position when the arms are lowered below the horizontal and forced back.

5. Bend Standing, Arm Stretching Upward (Stretch Standing Position). *Arms—bend; Upward—stretch!* The arms are stretched quickly and strongly upward in such a way that the arms are kept well back during the whole movement, just as in arm raising sideways upward, are fully straightened in the elbows, and are pressed back as far as possible without any hollowing in the loin; the arms must be parallel (Fig. 69)—that is, have shoulder-breadth distance between them—and be in line with the body seen from the side (Fig. 70). The hands, which must be stretched and held exactly in continuation of the arms, have the palms facing. The head must be held so that, from the side, a little of the face can be seen in front of the arms, but an equal amount of forehead and chin.

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wall and protrudes backward. This displacement is very common in 6–7 years old children. The reason is most likely that they have entered a period of rapid growth with their second dentition. The body is very sensitive during rapid growth, and consequently a weakening may occur for some reason or other; it may be unsuitable food lacking in vitamins, it may be rickets, a prolonged cold, want of sunlight, too little exercise, etc. As a consequence the muscles will be weakened. That does not matter much as regards the limbs, but a weakening of the muscles on which the carriage of the back and shoulders depends is more serious. The back will be rounded, the shoulder-blades will glide forward. The antagonistic muscles will be shortened, not least the pectoralis minor, which will give the shoulders that position so easily recognised and so much dreaded by parents. The parents see that the upper part of the trunk is being deformed: the head droops, the chest sinks and becomes flattened, and the shoulder-blades look like wings beginning; in the old days they were referred to as "winged shoulder-blades" (scapulæ alatæ).

Fortunately, it is not difficult to put the "winged shoulder-blades" back into their proper position. We have very effective exercises for stretching a shortened pectoralis minor. For little children the easiest is hanging position with the arms stretched. Every nursery ought to have a piece of apparatus in which the children can hang. Passive span bending, in which the child grasps the neck of the parent (Fig. 112, p. 223), is still better. These exercises, however, only give a passive stretching of the pectorals (major as well as minor). The muscles keeping the shoulders back are not strengthened. This strengthening is obtained by exercises and positions in which the shoulders are kept well back, such as bend, yard, and especially stretch position, which, besides lengthening the pectorals, give active work, under considerable shortening, to the muscles that keep the shoulders back in their proper position: trapezius, principally the middle part, serratus magnus, which keeps the lower corner and the inner edge of the scapula close to the chest wall. Stretch position and its near relative, span bending, are amongst the very best exercises for giving the shoulders and the upper part of the trunk, the bust, a good posture.

Arms—bend! The arms are drawn quickly and strongly straight down to the bend position with no hollowing of the loin.

Introduction. To begin with, and occasionally later, arm stretching upward is taken slowly in order that the pupils can learn, and be reminded to press the arms strongly backward in the stretching and bending. For this the adductors of the shoulder-blades must work in a very shortened condition, especially the middle part of trapezius, and the exercise therefore contributes to good carriage of the shoulders.—As children especially have a great tendency to let the head fall forward (Fig. 72) as the arms come into the stretch position, a small

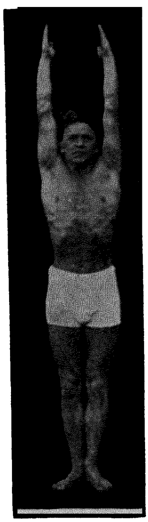


FIG. 69.

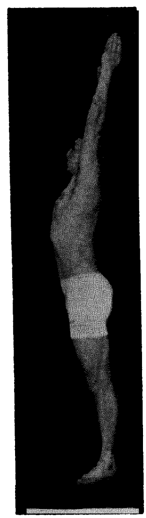


FIG. 70.

head bending backward should often be combined with the last part of the stretching of the arms (Fig. 73).

Common Faults. (*a*) The wrists are bent so that the hands point sideways or inward, the palms face somewhat forward, the fingers are not kept together and stretched.

(*b*) The elbows are not fully stretched.

(*c*) The arms come too far forward (Fig. 72) or too far from one another. It must, however, in this connection be emphasised that if, on account of stiffness in the shoulders, the arms cannot be brought far enough back in the stretch position while they are kept parallel, they should be held a little farther from one another; thus the head and chest get a better carriage.

(*d*) The head falls forward, the chest is lowered, and the loin hollowed in an effort to force the arms well back (Fig. 72). In order to work against these important faults the body should be brought a little forward by a slight movement in the ankles.

Muscle Work and the Importance of the Exercise. Amongst the fundamental gymnastic exercises stretch position is an exercise apart. If it can be taken up correctly and with freedom

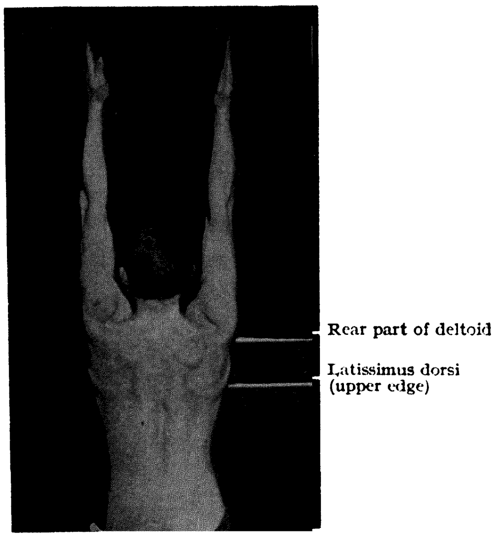


FIG. 71.

and ease, two of the principal aims of good physical development have been reached, namely good carriage of the shoulders and mobility of the dorsal spine. The anatomy connected with the position explains this, and here we have one of the best examples showing how the knowledge of anatomy forms a firm basis for the understanding of the fundamental gymnastic exercises.

From the bend position the upper arm is raised sideways by the *deltoideus*. But just before the arm has reached the horizontal, further movement in the shoulder joint is prevented by the acromion process, and as the arm has to be moved still higher the shoulder-blade must take part in the movement. The movement required is an outward rotation so that the socket of the shoulder-blade (the glenoid cavity) comes to face upwards. During this movement the deltoideus forces the arm to move with the shoulder-blade. By the powerful contraction of this muscle it is as if the shoulder-joint had been

FIG. 72.

FIG. 73.

eliminated and arms and shoulder-blade made into one bone (compare Fig. 68).

The outward rotation of the shoulder-blade is brought about by a pull on its three angles (see the arrows on Fig. 74). The strongest part of trapezius[1], the upper portion of its middle section, IIa, going from the lower half of the cervical spine to

[1] It is important to remember that trapezius is one of the "arm muscles." It lies, so to speak, at the root of the upper limb, and it *determines the carriage of the shoulder, supports it, and moves it.* The fibres coming from its broad origin grip the acromion process and the spine of the scapula firmly like a claw, and are able to hold the shoulder-blade in a definite position and to move it with great power. No movement of the arm in the shoulder-joint is possible without this muscle coming into action either to move or to fix the shoulder-blade.

Its three parts—the upper, the middle and the lower part—may act independently of one another. *The upper part* (I, from the back of the head and the upper 3 to 4 cervical vertebræ to the collar bone) is by far the weakest, and is only of small importance to the carriage and the movements of the shoulder-blade. It can move the head. *The middle part* (II, from the 3 to 4 lower cervical and the 2 to 3 upper dorsal vertebræ to the acromion process and the outer part of the spine of the scapula) is the strongest part. The position of the shoulder-blades (*i.e.*, the carriage of the shoulders) depends chiefly on the length and the strength of this part of the muscle. Owing to its many and thick fibres it is not directly inserted on the spinous processes but through a diamond-shaped tendinous sheet. When the muscle contracts and swells this sheet lies at the bottom of a marked hollow. It may be divided into two sections, which also may work independently. The upper section (IIa, from the 3 to 4 lower cervical vertebræ to the acromion) carry the shoulders, and with that the arms and any burdens in the hands. When carrying a heavy weight in each hand one feels that the muscle is very tense ; but the head can be moved freely forward, backward and sideways. This shows that part I, well situated for carrying the shoulders, does not take part in this work. If it did, this part of the muscle would fix the head by pulling like a stay rope in a ship when one carried a burden in the hands. Part IIa fixes the lower part of the neck only so that the head can move as freely as the upper part of the neck allows. *It is this part that carries the shoulder* (portator scapulæ).

If part IIa is too long and slack, owing to poor development, the shoulders droop. Exercises with the arms above the horizontal, and particularly in stretch position, are the best for shortening and strengthening it. In stretch position the acromion is lifted up about level with the 4th cervical vertebra (in supple individuals somewhat higher). The muscle is now shortened to about half its length and keeps the shoulder-blades rotated with great power (assisted by the lower part of serratus magnus). This is seen when a heavy weight is carried above the head, or in hand standing position when the weight of the whole body rests on the arms.

The shortening of the muscle is greatest in span bending. With the hands shoulder-width apart, the arms are forced backward in stretch position to the greatest possible extent. A comparatively great part of the body-weight—the greater the farther the feet are from the wall bars—rests on the arms and tends to make them give in the shoulders. Consequently a considerable strain is put on this muscle. This fact explains why span bending is able to help people to acquire good carriage of the shoulders.

Part IIb, from the 2 to 3 upper dorsal vertebræ to the outer part of the spine of the scapula, has its fibres running horizontally and *adducts the shoulder-blade without rotating it*, the only part of the muscle capable of this. This part (IIb) is the most important antagonist to the pectorals when they will pull the shoulders forward. This is seen most clearly in overgrip hanging body raising. During the movement from stretch to bend hanging position, part IIa, which is also an adductor, would counteract too strongly the downward rotation of the shoulder-blade if working as with great power it lifts the acromion, which must be lowered. It is therefore inactive, which is easily felt. Part IIb, on the other hand, is strongly contracted and acts against the forward pull on the shoulders by the pectorals, but only if it is well trained and strongly developed. To ensure the good position of the shoulders it is important to train this part of the muscle by taking exercises, such as arm bending, arm flinging, arm rising sideways, arm stretching upward, arm raising sideways-upward and forward-upward, span bending, fall hanging, arch hanging and overgrip hanging body raising with the elbows kept well back, and other similar exercises.

the acromion process, pulls at the outer and upper corner of the scapula. It is this part that carries the shoulders when the arms are hanging by the sides; it is therefore called the carrier of the shoulders (portator scapulæ). The lower part of trapezius pulls on the upper and inner corner and the serratus magnus on the lowest corner of the scapula (Fig. 74). The power with which these muscles turn the shoulder-blade is so

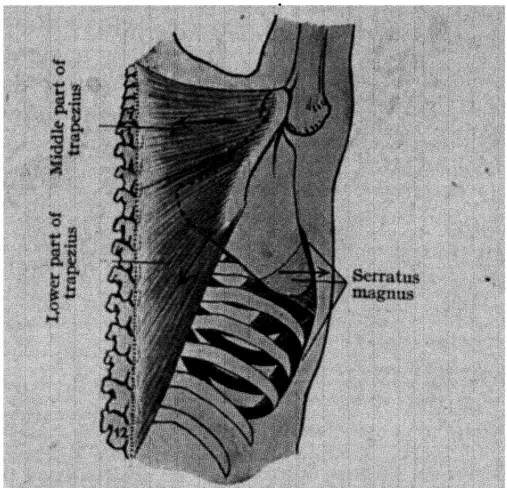


FIG. 74.—Outward rotators of shoulder-blade.

The lower part of trapezius, part III, from about the 3rd–12th dorsal vertebra to the middle and inner portion of the scapular spine, has the upper fibres running almost horizontally, the lower ones running more and more obliquely upwards. This part of the muscle adducts the shoulder-blade and draws it downwards, when there is an upward push or pull on it. In daily work the shoulder must often be held down, for instance, in all work involving downward pressure of the hand, such as digging, shovelling, etc., resting with the hands on a table. Similarly in the gymnasium in balance hanging on beam, or in parallel bars. In this position the outlines of part III will be seen distinctly, particularly so if the body is allowed to sink down between the shoulders. In stretch hanging positions it keeps the body up to the shoulder-blades, and it does so continually during a body raising, although the shoulder-blade here is rotated downward (and the muscle is an upward rotator). This indicates that its power as upward rotator is not great, much smaller than that of part IIa. But like IIb, it is also inserted near the axis of the shoulder-blade, IIb on the outer, IIIb on the inner side of it.

Because the right posture of the shoulders is of the greatest importance to the carriage, the trapezius is an important muscle, which by proper exercises should be trained to hold the shoulders correctly in a free and natural manner.

great that one may push the arms upward while carrying a heavy burden in one's hands (as in weight lifting) or carry the whole weight of the body during hand stand. While the rotation of the shoulder-blade takes place the arm will be stretched by the three-headed extensor of the forearm (triceps).

One should remember that the deltoideus is a continuation of the trapezius. Deltoideus cannot work without trapezius coming into action too.

The position of the shoulders in ordinary standing position depends on the portator scapulæ. If it be badly developed and too long, it allows the shoulders to fall forward and the chest is made "hollow." The shoulder-blades tilt forward so that their inner edges are moved away from the spine and protrude, in particular the lower corner; in that case one says that wings are forming. "Winged shoulder-blades" (scapulæ alatæ) are commonly found in 5–10 years old children that have entered a period of weakness with accompanying weakening of the muscles. The weakened portator muscles give way, lengthen and allow the shoulders to slide forward. A good development of the portator scapulæ is necessary in order to secure correct carriage of the shoulders. Stretch position and all exercises in which the arms are brought into stretch position are excellent in this connection.

In ordinary standing position, the acromion process is level with the 1st dorsal vertebra; in stretch position it is raised to the level of the 4th cervical vertebra (in supple people somewhat higher than in stiff ones), and during this work the portator muscle has shortened itself to half its length; it appears as a short, thick rope horizontally from the lower cervical vertebræ to the acromion. It will be seen that all work to and in the stretch position develop and shorten the portator scapulæ and enables it to give a good carriage of the shoulders, and this development is greater, the bigger burdens the arms have to carry. Hand stand and walking on the hands are therefore excellent exercises for producing good carriage of the shoulders. But even in stretch position without any weight in the hands the portator must work fairly strongly. It is not the weight of the shoulders and arms alone that it has to lift—which is easily done—but, what is of greater importance, it has to overcome the resistance of the muscles that rotate the shoulder-blade inward, back from the outward rotated position, and these muscles are pectoralis major and minor and latissimus dorsi.

The higher the arm is lifted and the further it is carried backward in stretch position, the greater is the resistance of these muscles, and the heavier is the work of the portator muscle, particularly so in stiff individuals ; but fortunately it is they who are mostly in need.

A further aim when working with stretch position is to preserve or regain the slight but very important mobility in a backward direction of the dorsal spine (see page 125). Anatomical knowledge gives us the explanation of the effect of stretch

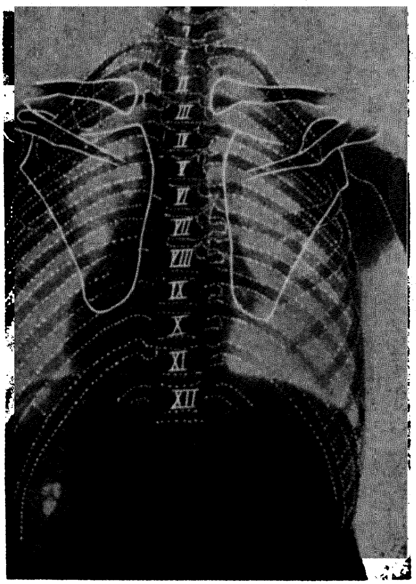


FIG. 75.—The shoulder-blades in bend position.

position on the dorsal spine. In the position, as just mentioned, the muscles from ribs to upper arm (pectoralis major and latissimus dorsi) and from ribs to shoulder-blade (pectoralis minor) are extended. When these muscles are extended they pull the ribs upward (as in inspiration) (Figs. 75, 76 and 77), and as each rib by two tight joints is connected with its dorsal vertebra, *the pull of the ribs will be transferred to the dorsal spine, with the result that its curve will be straightened as much as it is able to be.* Every time the stretch position is taken up there will be a movement of the joints of the dorsal spine which prevent them from becoming stiff. When carriage is concerned, it is of utmost importance to keep these joints mobile more than any others. This should be emphasized strongly, the more so as stiffness of the dorsal spine is extraordinarily common, yes, almost a rule already at the ages of 30–40 years, and stiffness is the beginning of round back (see page 114).

As stretch position is capable of moving the dorsal spine, it is an excellent means by which commencing round back may be detected (see page 98). Good stretch position denotes

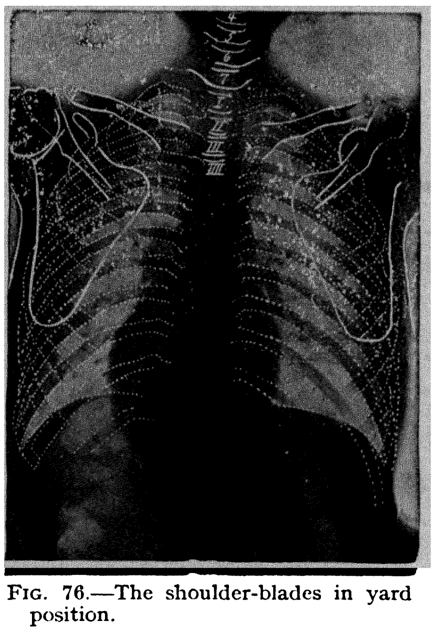


FIG. 76.—The shoulder-blades in yard position.

that the dorsal spine is mobile, poor stretch position that it is stiff and rounded. But stretch position does not belong to gymnastics only; far from it. Hardly any other exercise is done and ought to be done so often daily. We use it every time we "stretch ourselves" and then much more heartily and with greater effect than during gymnastics; one stretches onself till "every joint of the back creaks" because the dorsal part of the erector spinæ muscles contract very forcibly; it leaves one with a pleasant feeling of well-being. Nature can in no better way remind us of the importance of preserving the suppleness of the back. The mobility of the chest evidently means something as regards breathing. One may get out of the habit of stretching oneself either because one does not understand its importance or may be one considers it a lazy and unseemly movement. One has then done away with a good habit taught us by nature herself. When children have been sitting bent over their books during the lesson it would be only quite proper for the teacher to make them finish the lessons by stretching themselves a few times over the back of the seat.

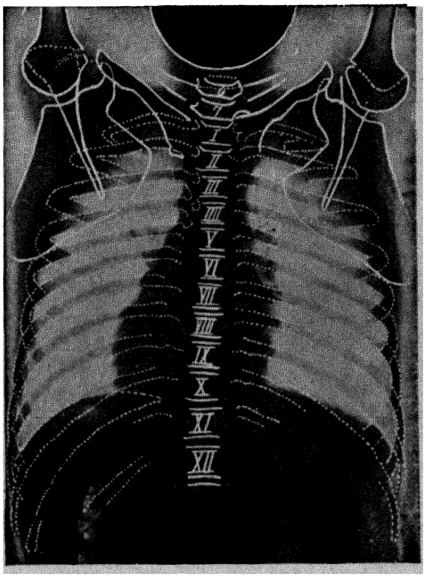


FIG. 77.—The shoulder-blades in stretch position.

From what has been said it appears that there are two reasons for poor stretch position: partly too short pectorals and partly a stiff and round dorsal spine. The latter reason is probably the more common. A crooked and stiff dorsal spine means a lowering of the ribs, and when the ribs cannot be raised the arms cannot be brought into a good stretch position even though the pectorals be not shortened.

It is, however, most likely that both causes are at work at the same time: when the back is crooked, the pectorals are short.

When the arm which is now stretched up is to be brought back to the bend position, the movement is done more quickly than gravity alone could do it. The arm is pulled down by muscle work, which is mainly the same as that used in heaving exercises—for instance, in overgrip hanging, arm bending. The shoulder-blade is rotated back again directly by *pectoralis minor and rhomboideus*, and indirectly, but much more strongly, by *pectoralis major* and *latissimus dorsi*. The movement in the shoulder-joint alone is caused by the two last-named muscles, by the *rear part of deltoideus* and the *long head of triceps*.

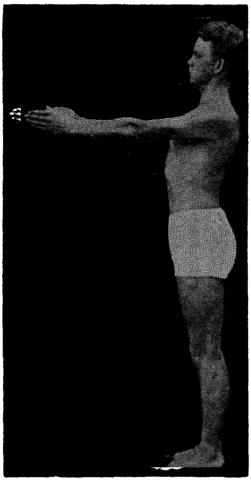


FIG. 78.

6. Bend Standing, Arm Stretching Forward (Reach Standing Position). *Arms bend! Arms forward—stretch!* The arms are stretched quickly and strongly forward at shoulder level and at shoulder-breadth distance from each other, the hands stretched, the palms facing one another. The shoulders are well back (Fig. 78).

Arms—bend! The arms are pulled quickly and strongly back to the bend position.

Whereas arm stretchings upward and sideways belong to the most effective form-giving exercises, arm stretching forward is of small importance for the carriage. The return movement from reach to bend position is the more effective part of the exercise, as in that the shoulders are drawn forcibly back.

Common Faults. The shoulders are drawn forward and lifted during the stretching so that the back is rounded from side to side (round shoulders) (Fig. 79). During the bending, the elbows are pointed backwards as the hands are not placed to the side of the shoulders (Fig. 66).

7. Bend Standing, Alternate Arm Stretching Upward and Downward. *Arms—bend! Left arm upward, right arm downward—stretch!* The left arm is stretched up to the stretch position, the right down to the erect position without the body being oblique.

Arm changing (*by numbers*)—1—2—3—4, or (*In time*) *Arms—change!* In the first movement both arms are bent, in the second they are stretched in the opposite direction.

Arms—bend! Both arms are brought to the bend position.

Arm stretchings are powerful and invigorating exercises. By giving the trapezius its proper length and strength they contribute well towards a good carriage of the shoulders. They also develop mobility to a certain extent. Arm bendings and stretchings sideways make the adduction of the shoulder-blades easier, and arm stretchings upward stretch the pectorals and *latissimus dorsi* and increase the rotation of the shoulder-blade. As regards mobility they are not, however, as effective as arm flinging and arm swinging.

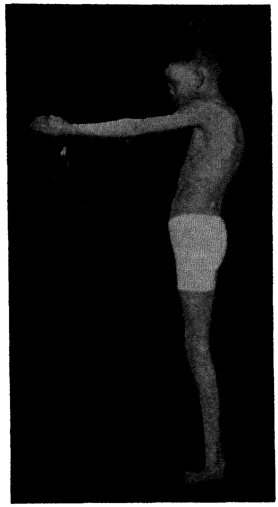


FIG. 79.—Faults in reach position.

They are good exercises for training the sense of time. The marked rhythm, which may be heard when they are done powerfully and in time, is stimulating. But the time beat is "hard" because one movement is not merged into the other: after each rapid movement there is a moment's absolute quiet. They are of a somewhat masculine type, which, however, should not prevent women from using them. When training the pupils to keep in time it is even better to take the exercises with a pause after each movement, the pause occupying as much time as each movement does.

As few exercises are done as rapidly as arm stretchings they are also effective in developing a quick response.

C. Arm Flingings

8. Standing, Arm Bending Across (Across-Bend or Fling Standing Position). *Arms across—bend!* The arms are well bent and raised quickly to shoulder height. The shoulders kept well back and lowered. The forearms are held in the same horizontal plane as the upper arms, the hands in continuation of the forearms, fingers together and stretched, elbows brought well back (Fig. 80).

Arms downward—stretch! The hands are brought quickly the nearest way down to the erect position.

Introduction. To begin with, the across bend position is most easily taken slowly from the yard position. From this position the teacher commands: (*Slowly*) *Arms across—bend!* or *Arm bending across*—1—2.

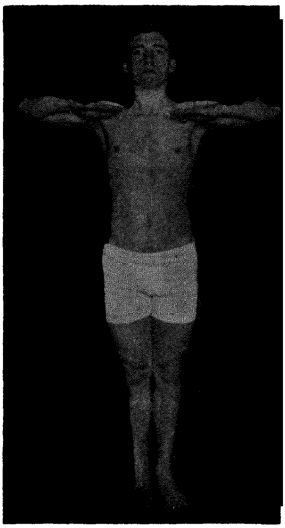


FIG. 80.

Common Faults. (*a*) The wrists are bent, the palms face somewhat forward.

(*b*) The elbows are not far enough back, and are held below shoulder level, while the hands are raised too high.

(*c*) The shoulders are raised.

(*d*) The head falls forward and the loin is hollowed. See paragraph 3, fault (*d*).

9. **Across-Bend Standing, Arm Flinging (Yard Standing Position).** *Arms across—bend! Arm flinging*—1—2, or *Begin! Halt!* In the first movement the arms are flung in an absolutely horizontal plane out to yard position without the shoulders being lifted and without the head falling forward. The whole arm must be strongly pulled back by the swing of the forearm, and must be kept then, as far as possible, in that position. In the second movement the forearms are brought back quickly to the starting position in the same way, without the upper arms coming forward.

Introduction. In order to learn to get the fling horizontal the pupils should do it slowly at first.

Common Faults. (*a*) In the first movement the flinging goes obliquely downward, the shoulders are lifted, and the shoulder-blades are tilted forward, and the head brought forward (p. 167).

(*b*) In the second movement the upper arms also come somewhat forward, sometimes to such a degree that the hands hit the chest.

Muscle Work and the Importance of the Exercise. The swing sideways of the forearm is done by the *triceps.* During this movement the upper arm will be pulled forward; it must therefore be fixed in its position by *infraspinatus, teres minor,* and especially the rear portion of *deltoideus.* All these muscles will also rotate the arm outward and the two latter will pull it downward. In the activity of these muscles is the explanation of the great tendency to let the swing go obliquely downward. The outward rotation is counteracted by *sub-scapularis* and the downward pull by the middle part of *deltoideus* and *supraspinatus.*

As the muscles moving the upper arm backward arise from the shoulder-blade, this must be fixed, and it is done by the middle portion of *trapezius* and by *rhomboideus,* which at the same time adduct the scapula (see Fig. 68).

When the movement in the elbow-joint ceases, the inertia of the forearms pulls the upper arms back too. In this way the shoulders are drawn strongly backward and the horizontal part of *pectoralis major* is stretched yet more strongly than in arm stretching sideways, thus helping to correct round shoulders (see paragraph 4, p. 172).

10. Across-Bend Standing, Arm Flinging Outward-Inward in One Movement. *Arm flinging outward-inward in one movement*—1. and so on; or *Go! Halt!* On 1 the arms are flung sideways and immediately back again.

This arm flinging may be done differently in 2 movements. In the first movement the elbows are brought a little forward and immediately with a quick pull drawn back to across-bend position. In the second movement the elbows are again brought slightly forward (in order to give a bigger range to the flinging) and the arm flinging is taken. This will provide an extra stretching of the pectorals. The arm flinging is most effective when directed a little obliquely upward and the trunk at the same time moved slightly forward. The exercise in this form is always performed rhythmically. It is generally known as *across-bend standing, elbow swinging and arm flinging.*

D. Arm Swingings

11. Standing, Arm Swinging Sideways (Yard Standing Position). *Arm swinging sideways—begin! Halt!* The arms are carried well back and swung to yard position, rather a little above than below shoulder level, and back again. For little children the exercise may be taken to a given number, for example, 10 or 15. The arms are then swung down to the sides with a slap on the leg. This puts life and go into the exercise and makes it easier to keep time. The children count loudly, but only for each slap. When the arms are brought to the sides they are immediately swung sideways again as if they had hit something springy. This makes the movement more elastic and light. The exercise may be stopped now and then in the erect position, at other times in the yard position. This tends to make the class attentive, and gives one an opportunity of correcting the positions of the arms. From the yard position the arm swinging may be taken freely, either on the spot or while running and swaying the body from side to side. The command is, "Fly like big birds!"

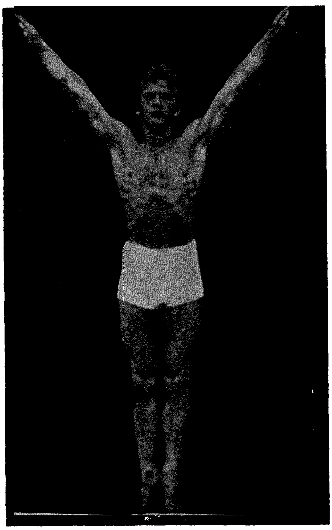


FIG. 81.

12. Low Cross Reach Standing, Arm Swinging Obliquely Sideways - Upward (Flight Standing Position). In the starting position the arms, slightly bent, are crossed in front of the stomach. From this position the exercise is taken on the command, *Arm swinging obliquely sideways - upward—begin! Halt!* The arms are flung to the flight standing position, a position in which the arms are stretched and held half-way between yard and stretch position (Fig. 81). The body is moved slightly forward, the heels are raised, and the back is straightened just at the end of the swing in order to stretch the pectorals as much as possible. The arms are swung back to the starting position without any pause in the flight position. The exercise is taken rhythmically, to begin with in individual rhythm. The chief effect is suppleness.

The rhythmical exercise may be combined with heel raising and knee bending: heel raising together with the swing sideways-upward, knee bending in the return movement, knee stretching in the following movement, and heel lowering during the arm swing downward-forward. The whole is repeated in the same order.

One can also "swing the arms as the coachman does when warming his hands." In the arm swinging downward-forward and the crossing the arms are lowered a little less and the hands slap the shoulders firmly. The swing sideways is, however, the more important in this exercise also and should not be neglected. The arms are raised a little above shoulder level and are alternately uppermost in the arm crossing.

13. **Yard Cross Sitting (Yard Kneel Sitting), Arm Swinging Forward-Sideways.** When the starting position has been taken the command is: *Arm swinging forward-sideways* (*with a handclap*, or *crossing the arms*)—*go! Halt!* The arms are swung a little obliquely forward-downward with a clap or a crossing of the arms and immediately sideways and slightly upward. The trunk moves forward at the end of the swing in order to increase its effect on the shoulders. At the same time the back is straightened and the head is lifted. The swing sideways must be taken with great vigour. Also the "coachman's" arm flinging may be done from these starting positions.

14. **Standing, Arm Swinging in a Curve between Reach and Yard Position.** *Arm swinging between reach and yard position—begin! Halt!* In the arm swinging from the one position to the other without stopping the arms pass through the erect position. The swinging should be free without any tenseness. The arms should swing in an even movement with the least possible exertion. The aim is a free and easy movement in the shoulder-joint. Neither mobility (the joints are not moved to their extreme limit) nor strength are produced.

It is a rhythmical exercise that goes very well with exercises such as foot placings sideways and forward (the foot is moved every time the arms are swung to yard position and only then). It also goes well with knee bending. In that case heel raising is taken with the arm swinging forward to reach position, knee bending with the swing downward from reach, knee stretching with the swing sideways to yard, and heel lowering with the swing downward from yard position.

15. **Half Stretch Half Drag Standing, Arm Swinging.** *Left arm upward, right arm backward—stretch! Arm swinging*

forward-upward, forward-downward—1—2. On 1 and 2 the arms are changed with a swing.

When the exercise has been learnt it can be done rhythmically.

It is difficult to keep the arms parallel as they are moved; therefore, the exercise at first should be done slowly, and now and then with a stop in the reach position.

16. Drag Standing, Arm Swinging Forward-Upward (Stretch Standing Position). *Arms backward—raise!* (Fig. 82). *Arm swinging forward-upward*—1—2, *or begin! Halt!* On 1 the arms, well stretched and parallel, are swung energetically forward - upward to stretch position. As the arms stop they will pull the trunk backwards so that the loin is hollowed and the head falls forward. This is counteracted by pressing the trunk forward and lifting the head at the right moment.

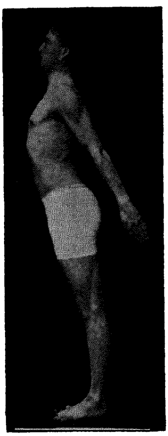


FIG. 82.

On 2 the arms are swung back to drag position. The shoulders are kept lowered, the head lifted, and the back straight. As the arms stop in drag position they are apt to pull the trunk and the head forward so that the back is rounded and the shoulders raised and moved forward. As a counter movement the back should be stretched, the head lifted, and the shoulders lowered.

The exercise ought to be taken slowly a few times to make sure that the arms are kept parallel. It is good as a rhythmical exercise, individual as well as joint-rhythm may be used. During this the body should rest well on the balls of the feet in order that the erect posture may be kept.

Common Faults. (*a*) The arms are parted and bent in the swinging.

(*b*) The back is hollowed and the head falls forward.

(*c*) In the downward swing the back is rounded.

Muscle Work and the Importance of the Exercise. The upward swing of the arms is done by the *front part of deltoideus* and the *upper part of pectoralis major* and by the *trapezius* and *serratus magnus,* which turn the shoulder-blade. This swing is stopped by the *pectorals* and the *lowest part of latissimus dorsi;* these muscles, therefore, are strongly stretched by the inertia of the arms. As a result of this, the ribs are lifted and the back is straightened (see p. 182 and Fig. 77).

17. **Standing (Speech St.), Arm Swinging Sideways-Upward (Stretch Position).** *Arm swinging sideways-upward* —1—2, or *begin ! Halt !* On 1 the stretched arms are swung sideways-upward, on 2 sideways-downward. The arms are kept well back during the whole movement. The trunk should be inclined slightly forward and the head lifted to avoid any hollowing of the back and nodding of the head. The hands are turned outward in the upward swing and with the palms facing downward in the return movement. As soon as possible it should be performed rhythmically. A clap above the head and a slap against the legs may be added. The exercise may be combined with skip and astride jump (p. 161).

Speech standing position—which is the old Swedish name for the position—is like drag standing with the arms turned so that the palms face outwards. The command for this position is : *With arm turning outward, arms backward—raise !* The arms are kept turned both in the swing upward and in the swing downward. Because of this the muscular work at the shoulders is felt somewhat differently.

Arm swinging sideways-upward may also be taken from the cross sitting or the crook sitting position, provided the hip-joints are so mobile that the back can be kept straight and the trunk moved somewhat forward.

One feels a distinct difference in the muscle work during arm swinging sideways-upward and forward-upward. In arm swinging sideways-upward the muscles keeping the shoulders back, especially trapezius, have a greater work to do. The exercise like arm raising sideways-upward, is therefore more effective as regards good posture of the shoulders, and it ought to be used frequently and just as much as arm swinging forward-upward. The one mainly develops strength, the other mobility.

18. **Drag (Stride) Lean Standing, Arm Swinging Forward-Upward (Stretch [Stride] Lean Standing Position).** *Left foot sideways—place ! With arm raising backward trunk (slightly) forward—lean ! Arm swinging forward-upward*—1—2, or *begin ! Halt !* Beginners lean only slightly forward, later the leaning should be increased. The lean position fixes the loin so that it does not give. Stress should be laid on a vigorous arm swing upward. Towards the end of the arm swing a little energetic pull forward of the trunk should be done as a counter movement. In that way it will make the

shoulder (the "muscle-joint") mobile to a considerable degree by stretching the pectorals and latissimus dorsi. In order to give the muscles that rotate and adduct the shoulder-blades active work to do in a very shortened condition the arm swinging may stop in stretch position for a moment in every fifth swing or so (see p. 51).

19. **Speech (Stride) Lean Standing, Arm Swinging Sideways-Upward (Stretch [Stride] Lean Standing Position).** *Left foot sideways—place! With arm raising backward and arm turning, trunk (slightly) forward—lean! Arm swinging sideways-upward—begin! Halt!* The arm swinging as under 17. The lean position makes the swinging more fatiguing, but also more effective.

20. **Arm Circling.** Arm circling is first taken with one arm at a time, later with both arms simultaneously.

(*a*) **Stride Standing, Arm Circling Forward (Backward) with One Arm.** In the stride position the command is: *Arm circling forward (backward) with the left—go! With the right—go! Halt!* The hand is lightly closed, the arm swings round in as large a circle as possible (in the sagittal plane). It should be swung well upward and pass close to the ear and well back; the trunk kept vertical.

Arm circling must first be taken slowly, so that the pupils may learn to keep to the proper circular path, but soon it should be done quickly.

The shoulder moves with the arm. It is drawn forward with the arm in its forward swing and backward in its backward swing. The slight trunk twistings caused in this way should not be checked, but rather encouraged as they make the circle through which the hand moves bigger (the diameter increases by 10 to 15 inches). The greater swing has an increased effect on the mobility of the shoulder. Because of these twistings, stride position provides the steadiest starting position. The passive arm should be placed on the hip in wing position, as it otherwise cannot be kept still.

Arm circling backward should also be practised. The same muscles are working, but in the opposite order so the co-ordination is different.

Common Faults. (*a*) The trunk leans forward or sideways.

(*b*) The arm is not stretched. It is swung in front of the body, and therefore not enough backward. This diminishes its effect on the mobility of the shoulder.

(*c*) The arm is not lifted high enough and not brought close to the ear when passing through stretch position.

(*b*) **Stride Standing (Walk St.), Arm Circling Forward (Backward) with Both Arms.** When the starting position has been taken the command is: *Arm circling forward (backward) with both arms—begin !* (or *go !*). The arms fully stretched and with lightly closed hands are swung round in large circles and as near the sagittal plane as the mobility of the shoulder allows. In reach, stretch, and the erect position the hands should be shoulder-width apart. During the swing backward from stretch position through drag to erect position the distance will be bigger, the bigger it is the stiffer the shoulders are. The back must be kept straight and the head lifted, which is not easy because of the instability caused by the movements of the trunk.

In this exercise, as in the previous one, the arms should be moved slowly round to begin with so that the proper path of the movement may be learnt.

As the arms and shoulders move together there is no twisting of the trunk here.

On the other hand, owing to the circling of the arms the centre of gravity is constantly shifting forwards and backwards. The necessary balancing in stride position must be secured by movements in the ankles only, and not, as is easier, by small movements in the loin, hips and head going forwards and backwards alternately. These latter movements may be avoided most easily in walk standing position which provides a good supporting area in the direction forward-backward. Walk standing position should be used frequently, especially for beginners.

As in the former exercise and for the same reasons, arm circling in the opposite direction, backwards, should be practised frequently.

Common Faults. (*a*) The balance is kept by movements of loin and neck.

(*b*) The arms are not stretched; they are swung in front of the body so that the hands are brought close together or the arms crossed.

(*c*) The arms are not lifted sufficiently and are too far from the ears when passing through stretch position.

(*d*) The arms do not keep together. One arm describes a bigger circle than the other, due to the one arm being more developed and better trained than the other.

Muscle Work and the Importance of the Exercise. Arm Circlings, whether with one or both arms, are excellent exercises for making the shoulders supple. And mobility in the shoulder-joint and the muscular connection between shoulder-blade and trunk (the "muscle-joint") is essential for the harmonious development of the shoulder and chest region and for free and easy arm movements. But also the mobility of the thorax is affected by arm circlings.

The effectiveness of these exercises as regards suppleness is indicated by the very lively movements of the shoulder-blades during arm circlings. Every muscle is influenced, either by active contraction or passive stretching, those going from shoulder-blade to trunk (*trapezius, serratus magnus, rhomboideus, pectoralis minor*), from shoulder-blade to arm (*deltoideus, supra- and infra-spinatus, teres major* and *minor, subscapularis, triceps,* and *biceps*), and from trunk to arm (*pectoralis major* and *latissimus dorsi*).

By the stretching and shortening of the blood vessels, especially the veins, of the muscles and other soft tissues in the shoulder region, the circulation is stimulated, and that explains why these exercises soon give one a feeling of warmth even on a cold day. The increased circulation probably explains, too, the beneficial effect these exercises have on rheumatism and other minor ailments of the shoulders.

Arm circlings should therefore be used frequently in school and in voluntary classes. One should use them during advancing years as they help to keep away from the arms, shoulders, and chest the stiffness of old age.

E. Arm Raising

21. **Standing, Arm Raising Sideways (Yard Standing Position).** *Arms sideways—raise !* The arms, fully stretched, are raised slowly to shoulder height ; from the very beginning of the movement they are kept well back, with the palms facing downward, hands in line with the arms, shoulders pulled down, and head high.

Arms—lower ! The arms are lowered in the same way.

The command can also be : *Arm raising sideways*—1—2, or *begin ! Halt !*

Common Faults. (*a*) The arms are not kept far enough back. (*b*) The shoulders are lifted and the head brought forward.

22. **Yard Standing, Arm Raising Upward (Stretch Standing Position).** *Arms sideways—raise! Arm raising upward*—1—2, or *begin! Halt!* On 1 the palms are turned upward and the arms raised to the stretch position; on 2 they are lowered to yard position, with the palms upward, as described in 23.

Arms—lower! The palms are turned down and the arms lowered to the erect position.

23. **Standing, Arm Raising Sideways and Upward (Stretch Standing Position).** *Arm raising sideways and upward*—1—2—3—4. On 1 the arms are raised to the yard position, as in 21; on 2 the palms are turned upward and the arms are raised slowly to the stretch position, still fully stretched and kept well back; on 3 the arms are lowered to yard position, with the palms upward; on 4 they are turned down, and the arms lowered to the erect position.

The exercise can also be done in 2 movements. The command is: *Arms sideways-upward—raise! Sideways-downward—lower!* or (*in 2 movements*) *Arm raising sideways-upward*—1—2. On 1 the arms are raised up to stretch position, and on 2 lowered to the erect position. Both in the raising and lowering the hands are turned as they pass the yard position without any stopping of the arms.

If the exercise is used as a breathing exercise it is always done in 2 movements.

In this case the hands can be turned (to speech position) before the arm raising sideways begins, and kept in that position until the lowering is finished. This gives a rather stronger pull backward in the shoulders and a more even movement, as there is no temptation to make a stop at shoulder height, which easily occurs if the arms have to be turned at that point.

Muscle Work and the Importance of the Exercise. The muscle work in all essentials is the same as in arm stretching upward from the bend position (p. 174 and following). The ribs are raised and the back is straightened just as in arm stretching and arm swinging upward, but in this exercise the ribs are more raised because the slow movement allows of a deep inhalation.

Arm raising sideways-upward is the best and most effective of all arm raisings as it causes the trapezius to work in a strongly shortened condition.

24. **Standing, Arm Raising Forward-Upward, Lowering Sideways-Downward.** *Arm raising forward-upward, lowering*

sideways-downward—1—2 ; or *begin ! Halt !* On 1 the arms, fully stretched, are raised slowly forward-upward through the reach position to the stretch position. On 2 the arms are lowered sideways-downward as described in 23.

Common Faults. (*a*) The arms begin to go sideways-downward before they quite reach the stretch position ; by this the most effective part of the exercise is lost.

(*b*) When the arms are pressed back in the stretch position the loin is hollowed and the head falls forward. The latter fault is corrected by a slight head bending backward (see p. 177, Fig. 73).

In modern gymnastics, especially for women, the various arm exercises, mostly arm stretchings, swingings, circlings, and raisings, are combined in many different ways. This is done for the sake of variety, but also to obtain rhythm, lightness, co-ordination, and to secure the attention of the class. Many of these combinations are very attractive, but here, as in other complex exercises, the different movements must be learned well before combinations should be attempted. If not, the exercises become ineffective, slack and feeble, only a distorted picture of the free and easy movements intended. Too quick time also lessens their effect.

Arm movements, not arm positions only, may be combined with trunk and leg exercises, adding rhythm and go to these exercises. But if they are used to such an extent that the arms are never kept still it is an exaggeration.

Examples of easy combinations of arm exercises are given below.

Standing, Arm stretchings in one or more directions, the one arm one count before the other.

St., Arm stretching upward and downward, Arm swinging sideways-upward and sideways-downward.

St., Arm stretching sideways, Arm swinging downward-sideways, Arm stretching upward, Arm swinging sideways-downward. Before the arms swing sideways-downward from stretch position the hands may be brought together with a clap or the tips of the fingers lightly touch (in gymnastics for women) ; both the stretchings and the swingings done quickly.

St., Arm swinging forward-backward and forward-upward. The swing forward-upward is the principal movement and has to be taken with full vigour ; the swing forward-backward is only a preparation for it. Instead of the swing forward-upward an arm circling may be taken. This latter, also, should be done with full vigour.

St., Arm swinging sideways-downward, half way sideways-upward (to *flight position*) *and twice sideways-upward* (*with clap or finger touching*).

St., Arm swinging sideways with Heel raising. The arms may be swung down loosely, slightly bent at the elbows and crossing one another in front of the body.

Bend cross (crook) sitting, Arm stretching forward, Arm swinging sideways and 1, 2 *or* 3 *pulls backward in yard position.*

Bend cross (crook) sitting, Arm stretching upward with 1, 2, *or* 3 *pulls backward in stretch position.*

§ 16. Neck Exercises

Introduction

The back is involved in all our movements, also in those of arms and legs. During leg exercises the pelvis is moved and with that the spine (see page 141). By means of the shoulders the arms are suspended from the lower cervical vertebræ ; because of that, arm exercises will act on the back too. But the movements produced here are only slight. The training proper and the forming of the spine demand special exercises. As regards the cervical spine we use neck exercises ; the dorsal and lumbar spines are acted upon by trunk exercises : lateral, abdominal, and dorsal exercises. The primary object of the neck exercises is to develop the muscles and the mobility of the cervical spine so that the turning and bending of the head will be free and easy in all directions. People who have lost the easy mobility of the neck have difficulty in finding their bearings by the help of their eyes.

But furthermore—and most important—neck exercises must play their indispensable part in giving a good carriage to the head. The effect of the head on the shape and carriage of the spine is enormous. For this reason those exercises, the corrective effect of which extend beyond the 7 cervical vertebræ to the dorsal spine, especially its upper half, are the most important. It is on the carriage of the upper 5-6 dorsal vertebræ that the shape of the neck and the position of the head depend first and foremost.

This upper half of the dorsal spine is the stiffest part of the whole spinal column, and it is consequently in that part that round back generally begins to develop. By the increased curving of the dorsal spine caused by round back, the upper 5-6 dorsal vertebræ will be inclined forward, the cervical column will move with it into the same inclined position, but in order to be able to look forward one will raise one's head by bending the upper part of the cervical spine backwards ; its slight physiological curve will therefore be increased, i.e., lordosis of the neck will set in as seen in all people with round backs.

On the other hand, a straight, *i.e.*, a normally curved, back has its upper half almost vertical (Fig. 33), consequently the cervical spine here is also almost vertical with only a slight curve forward. If the curve of the neck shown in Figs. 36 and 37 were kept, the face would be turned somewhat upward when the back is straightened, and it could only face forward when the curve was brought back to normal Therefore, the straighter the back the straighter the neck.

The heavy head (about 8 lbs.) resting like a ball on the mobile column must be kept in position by many and strong muscles. The work put on these is smaller when the head is kept erect, bigger when the head and trunk are moved forward as in many daily occupations or when the head is drooping as in round back.

The muscles of the neck have to carry not only the head, but also partly the ribs, and, what is more, the shoulders, and the arms, which are all suspended from the cervical spine.

From the neck the elevators of the ribs, the scalenes, go to the upper ribs and help to hold them up. From the head the oblique neck muscle, sterno-mastoid, goes to the collar bone and sternum. This may also help, sometimes, to carry the chest. The pull forward of these muscles must be counteracted by the cervical extensors of the back.

The heaviest weight for the neck and the upper dorsal spine are, however, the shoulders and arms. The shoulders, and with them the arms, are suspended by the part of the trapezius going from the 3-4 lower cervical vertebræ to the point of the shoulder (acromion). Their heavy pull on the lower half of the cervical spine must be counteracted by the dorsal extensors in the region of the lower neck and the upper chest. As this pull may be redoubled many times because of the work the hands and arms have to do, it is clear that the muscles of the neck must be very strong (some of them come from the middle of the dorsal spine so they will also affect the upper half of it). Apart from the thin cervical spine, the trachea, and œsophagus, the thickness of the neck is due to its many and strong muscles. A well-developed neck is an essential part of a fine and harmonious body. A thin neck is more disfiguring than a "bull-neck."

One gets a clear impression of the strength of the neck muscles if one tries to force down the head of a person lying on his front and resting on his elbows. A strong pressure is necessary, although one has a far longer lever to act upon than the muscles resisting.

The stoop of old age is caused by these muscles giving way little by little to the constant heavy weight which they have to carry. To avoid this stoop the muscles must be kept in training, and must occasionally be made to contract as much as possible, and they do that when the body is well straightened.

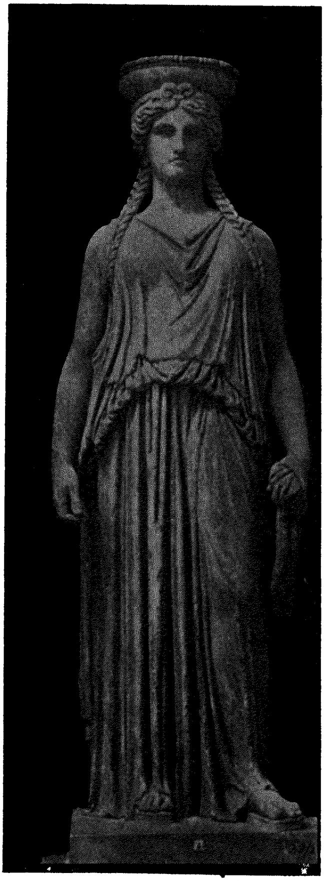
From the above it will be seen that the exercises which move the 5 or 6 upper dorsal vertebræ sufficiently far backward to make a round back straight are very important where good carriage is concerned.

Amongst the common neck exercises, head pressing backward is the best and the most used. But it is evident that this, and the other ordinary neck exercises, head turnings and head bendings sideways, demand so little muscular exertion that they cannot develop the strength of the neck muscles very much. They can, however, enable the pupils to find the correct posture and to acquire the habit of carrying the head well. They also help to preserve mobility of neck and dorsal spine.

Because of the muscular connection between head and neck and the chest provided by the sterno-mastoid and the scalenes, and because of the straightening of the dorsal spine during a head pressing backward, this exercise is also a good breathing exercise.

In order to develop the strength of the neck muscles one has to resort to exercises such as back lying, shoulder raising (raising also the seat from the ground), lean long sitting, trunk raising with living support, head support hanging position, etc.

The carrying of burdens on the head—a familiar custom till only a generation or two ago, and still used in mountainous tracts—is excellent practice for a good carriage. In orthopædics it is used as a means of curing certain postural faults, and in gymnastics for girls some teachers make their pupils carry sandbags on their heads during balance exercises.



The neck muscles are given a considerable work to do in balancing the weight on the head. As this is done with less exertion when the head is lifted and the spine straight than when the head is poked forward, the whole back, also the loin, will be stretched and kept balanced in a straightened position. To this can be added that in order to keep the weight balanced on the head, the movements of pelvis and

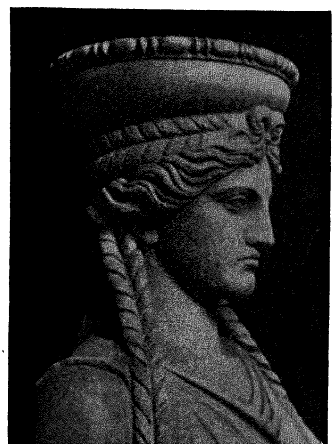


FIG. 83. FIG. 84.

Caryatid from Acropolis seen from the front and from the side.

spine during walking must necessarily be soft and elastic in order to keep the head still under the weight. This carrying of weights may consequently make walking light and easy.

The ancient Greeks must have realised the effect on posture of weights on the head. The Caryatids of the Acropolis bear witness to this. Fig. 83 shows the classical posture, and in

Fig. 84 the fine position of head and neck is seen from the side.

1. **Standing, Head Bending Backward.** Head bending backward is done in two ways so different from one another that they may be looked upon as two different exercises.

(*a*) **Standing, Head Pressing Backward.** *Head backward—press! Upward—stretch!* The chin is drawn well in, and by that, as stated on p. 124, the curve of the neck is straightened (Figs. 85, 86; compare with Fig. 38, p. 124, where the head is bent so far forward, however, that the curve is reversed). While the long muscle of the neck, longus colli, keeps the neck straight, the head is moved backward. This movement takes place not in the neck, but as far down as *in the middle region of the dorsal spine.* The upper 4 or 5 dorsal vertebræ are drawn back together with the neck. Their ribs are lifted.

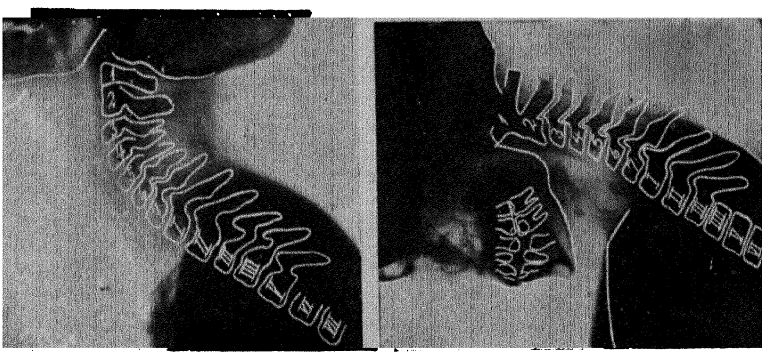


FIG. 85. FIG. 86.

By the drawing-in of the chin, the curve of the neck is straightened.

The sterno-mastoid and the scalenes are stretched as the neck becomes longer during the stretching and as the head moves backwards. They will therefore help to raise the ribs. The more the ribs are raised by inhalation the more the neck and head can be pressed backward. Inhalation should, therefore, not be hindered in this exercise (Fig. 87).

Performed in this way, both the cervical and dorsal curves are straightened. The old name, head bending, is therefore misleading. The exercise is a continuation of the movement that takes place when one goes from the relaxed to the erect position (Figs. 89 and 88, which show its effect on the chest).

It is the beginning of a trunk bending backward, so it is not only a neck exercise, but also a dorsal exercise.

To increase its effect and to make the spine more mobile, the head may be drawn backward with small, energetic, strong, and even pulls in the backward pressed position.

Head pressing backward may be done in toe standing position. The stretching of the body accompanying this position helps towards a correct performance of the exercise. The increased balance difficulty counteracts any tendency towards hollowing the loin.

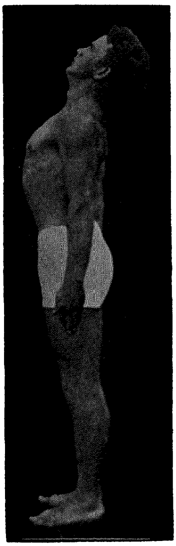


FIG. 87.

FIG. 88.—Twelve year old boy with good carriage.

FIG. 89. — The same boy in relaxed position. Note the difference in height.

Owing to its effect on the chest, head pressing backward is an excellent breathing exercise. The movements involved are only slight so it may readily be suited to the momentary breathing as it can be performed quicker than other breathing exercises connected with arm raisings. As some pupils breathe more quickly after exertion than others, it should be taken in individual rhythm, to which it lends itself well. When the breathing has been calmed down it may be taken in joint-time to the command. *Head pressing backward*—1—2.

Introduction. When done in standing position the pupils will often make themselves stiff in their effort to stretch the neck and back. The movement is then apt to take place in the loin. To avoid this, it may be introduced in cross or crook sitting position, which will prevent bending of the lumbar spine.

Common Faults. (*a*) The chin is poked forward and the neck is bent instead of stretched (Fig. 90).

(*b*) Shoulders are lifted instead of lowered as much as possible.

(*c*) The loin is bent owing to inability to localise the muscular work to neck and dorsal region.

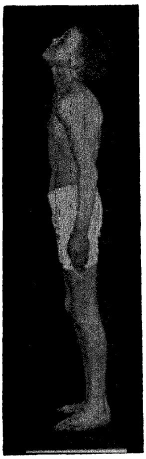


FIG. 90.

FIG. 91.

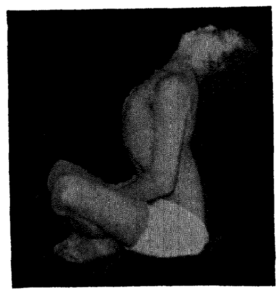


FIG. 92.—The loin of the boy is too stiff and the lumbar curve is therefore situated too high up.

(*b*) **Standing, Head Bending Backward.** *Head backward—bend! Upward stretch!* The head is drawn backwards as far as possible with the chin well raised. There should be a feeling of tenseness in front of the neck, as the tension exerted is supposed to have a beneficial effect on the organs situated in front of the neck column (Fig. 91). Also here cross or crook sitting is good for children and beginners (Fig. 92).

Muscle Work (Fig. 93). The ***rectus capitis anticus major and minor*** draw in the chin; to straighten out the forward curve in the neck the ***longus colli***, which lies in the front of the neck in the same way as *erector spinæ* on the back, must work. The head is then moved backward by the *cervical parts of erector spinæ*, etc. During the stretching of the neck and its movement backwards, the origins and insertions of the sterno-mastoids and the scalenes are moved apart. Consequently these muscles, which are not innervated, will act like elastic ligaments and pull the ribs upwards.

2. Standing, Head Bending Forward. *Head forward—bend! Upward—stretch!* The chin is drawn in so strongly that the head is bent somewhat forward without the neck moving forward very much. In this way an attempt is made to stretch out the curve in the neck (Fig. 86) which is generally too large. It also means a strengthening of the muscles involved, especially the *longus colli* (Fig. 93).

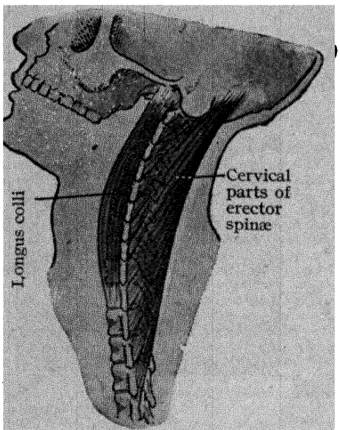


FIG. 93.

One often sees the head pulled down towards the chest in this exercise, but when taken thus the curve of the neck is not stretched and the longus colli is not working; the movement then is almost entirely a rounding of the back.

Back lying is a good starting position as the muscles concerned now have to lift the heavy head. The curve of the neck is strongly stretched when the movement is limited to a forcible drawing-in of the chin with only a slight raising of the head from the floor. The higher the head is lifted the more the back is rounded, and the more of the work is done by the sterno-mastoids whereas the effect on the curve of the neck is lessened.

If the curve of the neck has been permanently increased, the cervical parts of the *erector spinæ* have been correspondingly shortened. The power necessary for lengthening these strong muscles and straightening the curve cannot be supplied by the comparatively weak *longus colli*. Here, as in the correcting of hollow back, passive exercises are needed. Such exercises are back lying, high leg raising with the feet touching the floor behind the head. The weight of the body will now help strongly in straightening the curve of the neck. The same is attained, even to a greater degree, in forward and backward rolling somersault on the mat.

3. Standing, Head Turning. *Head to the left—turn!* The head is turned slowly and strongly as far to the left as possible with the face kept vertical, the head well back, chin in, and body steady.

Forward—turn ! The head is turned to straight forward.

If the head turning is to be done quickly, the command is : *Quick head turning*—1. (*To the right*)—2.

While the head is turned large nodding movements (head bending backward and forward) may be taken.

The mobility acquired through head turnings is of greater importance in daily life than one is apt to think. The greater the mobility the easier it is during walking or cycling, etc., to turn the head when one wants to look behind. A neck with normal mobility allows a head turning of 180 degrees with the shoulders and trunk kept still. The loss of mobility causes considerable inconvenience, so it is worth while doing what one can to preserve it during advancing years.

Common Faults. (*a*) The head is brought a little forward, and therefore loses its lifted position.

(*b*) There is a bend of the head to one side, generally to the side to which the turning is taken.

(*c*) The shoulders go with the movement.

4. **Standing, Head Bending Sideways.** *Head to the left—bend !* The head is bent slowly and strongly as far to the left as possible. During the movement it must be kept well back with the face turned straight forward.

Upward—stretch ! The head is raised to the vertical position.

While the head is bent sideways it may be moved forwards and backwards. If these movements are large they may contribute towards mobility of the neck.

Common Faults. (*a*) The head falls forward.

(*b*) The head turns slightly to one side or the other.

(*c*) One or other of the shoulders is raised.

5. **Standing (Stride St.), Head Rolling.** *Head forward—bend ! Head rolling to the left—go ! Halt !* The head should describe large circles ; the larger the circles the more useful the exercise is in increasing mobility of the neck.

As stated on p. 199, the neck exercises already described do not strengthen the neck muscles greatly, particularly not the strongest, the cervical part of erector spinæ. Fortunately we have other exercises for developing them. In all exercises where the trunk is swung quickly downward and upwards (as in trunk bending downward) or from side to side (as in side bendings), and in exercises such as upward circling, rollings on the mat (somersaults), "head spring," "hand spring," "back spring," cart wheeling, over-swing, etc., the head, which may be looked upon as a heavy ball, is swung so vigorously that the neck muscles are brought strongly into play. To form an idea of this one may try to move up and down with one arm a dumb-bell weighing about 8 lbs.

In gymnastics there are also exercises which give the neck muscles work corresponding to their strength and which are therefore able to develop them. They were formerly grouped as dorsal exercises. A few of the best of these are described below.

6. **Stride (Ear Stride) Crook Back Lying, Trunk Raising.** Crook back lying position with the feet apart is first taken. The head is put in the right position by a stretching of the neck and a drawing in of the chin. Then the shoulders are lifted from the floor. During this the neck must not be curved, nor the chin poked, and the back of the head drawn towards the body. While the shoulders are off the floor the seat is raised and lowered slightly a few times without the neck relaxing and being pressed forward. During this trunk raising the muscles at the back of the neck are given strong work to do.

The exercise is easiest when the arms are kept by the sides; by pressing the hands against the floor they may assist in the raising.

The arms may also be held in ear position, the hands overlapping and forming a rest for the back of the head (see Fig. 114, p. 225).

7. **Stride Fall Long Sitting, Trunk Stretching with Head Support.** No. "ones" sit in long sitting position with the feet apart and supported against a wall or against the feet of a fellow pupil sitting opposite. No. "twos" stand behind in lunge position, hands overlapping and supported on the knee, palms upward so that No. "one" can rest the back of his head in the palm of the uppermost hand when leaning backward.

Trunk—stretch! Trunk—lower! By pressing the head well backward with the chin drawn-in the body is raised in a flat arch from head to feet (Fig. 94). After some practice the arms may be raised simultaneously forward-upward to stretch position.

No. "ones" may also give support in back lying position with the arms in reach position, as shown in Fig. 95.

Until the neck muscles are sufficiently strong the neck, and not the back of the head, may be placed against the supporting hands as this gives a shorter lever for the weight of the body to act upon.

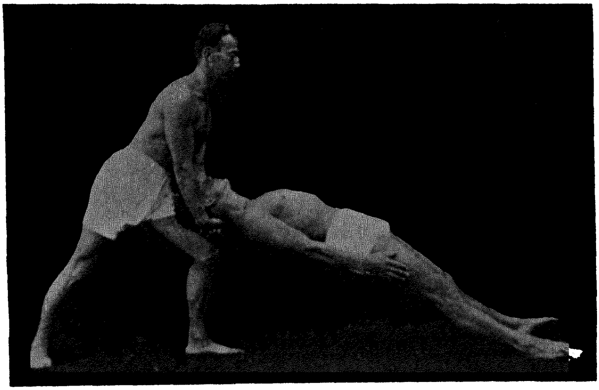


FIG. 94.

8. **"Log Raising."** No. "ones" lie on their backs with feet apart. No. "twos" stand behind in stride position, grasp those lying under the head with both hands and raise them up to standing position (Fig. 96). Before they are grasped, No. "ones," the "logs," must keep the heads well back and lift the shoulders from the floor. This makes the extensors of the

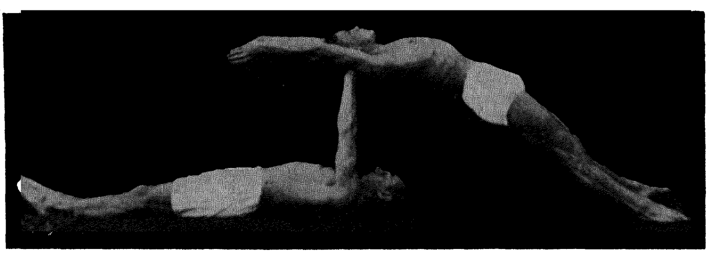


FIG. 95.

back, especially in the neck region, contract strongly. To begin with, the "logs" are grasped under the neck close to the shoulders, later, as their strength increases, the hands are moved further up, as far as the back of the head.

To make the exercise stronger in its effect, the "logs" may be raised half up, then dragged on their feet a little backwards ("pulling the sleigh") before being raised to standing position.

Another game-like form of this exercise is called "shifting the logs." Here the children are numbered off in threes. No. "two" lies on his back as before. Nos. "one" and "three" lift him by grasping the neck and the heels and carry him, for example, across the gymnasium, No. "two", the "log," keeping stiff.

9. **Head Support Hanging.** *Hanging position—now! Rest!* No. "ones" stand on the wall bars at such a height that they, by, stretching the arms and bending backward, can rest the back of the head in the hands of No. "twos" who are behind them in walk or short lunge position, with one arm vertically upward. On the word *now!* No. "ones" take their feet from the wall bars and hang with the back of the head and the arms supported. On *rest!* the feet are again placed on the bars.

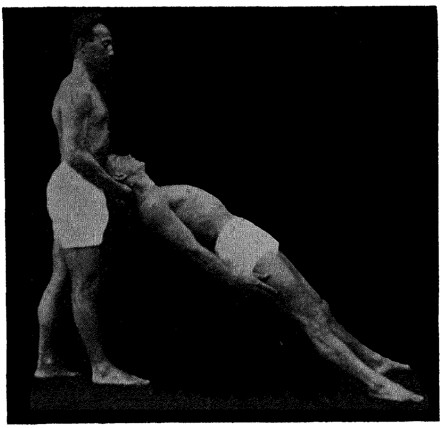


FIG. 96.

To begin with, No. "ones" grasp a bar at about their hip level. The arms will then be directed obliquely downward and the chest will be close to the wall bars. A greater part of the weight of the body is now resting on the arms (Fig. 98). The exercise is thereby easier both for the one hanging and the one supporting; in fact, so easy that even children are able to do it.

The higher the hands, the more the arms approach the horizontal, the more difficult for both (see Fig. 97).

The one supporting must bend his hand well backward so that the head rests against the root of the hand. He must not grasp his partner's head with his fingers as this pulls on the hair and hurts. To begin with, the hand should be placed well under the head of the partner so that the forearm is close to his back. As strength increases the hand may be placed further back.

The one supporting must stand well forward under his partner. He cannot give a steady and proper support unless his arm is held almost vertically upward.

When the pupils are well trained, No. "one" may stand on the floor, grasp a wall bar at a suitable height (head- or shoulder-height), and then with a jump get into the hanging position. In that case it is necessary that he pulls his head well back and his chest well forward in the jump. The supporting partner places his hand in position before the jump, follows all the other's movements and helps him up by a steady pressure.

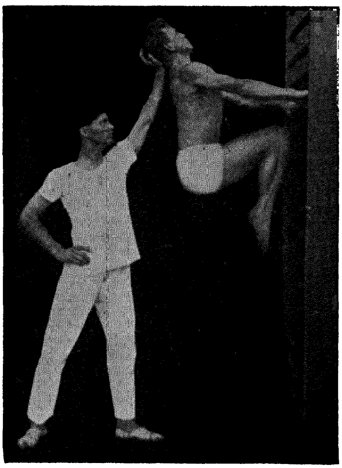


Fig. 97.

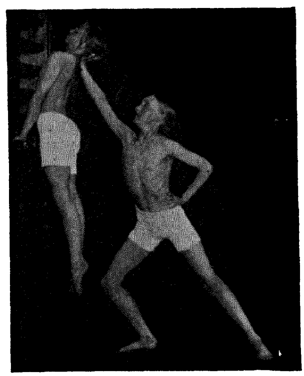


Fig. 98.

The length of his lunge depends on the height at which his partner grasps the wall bars (the lower the bar, the longer the lunge); and his arm must be fully stretched and vertical when his partner is in position as otherwise he cannot carry him. In this form it may also be taken at the beam.

A double knee raising while the position is held makes the exercise more effective, at the same time not only the dorsal but also the lumbar curve is straightened (Fig. 97).

Head support hanging is so effective that it should be used diligently, also by girls and women.

10. Prone Falling, Head Pulling. No. "ones" and "twos" are lying opposite one another in prone falling position. A band or girdle is put around the back of the head; also a skipping-rope with the ends tied together may be used. If it hurts the neck a folded handkerchief may be put between the rope and the neck. Each one tries to pull his opponent after him. The exercise is an old popular game.

§ 17. Span Bending

Span bending is the best form-giving exercise in the Ling system. That, more than any other exercise, shows the gymnastic genius of Ling, his intuition and ability as an artist, a sculptor with the living body as material. It shows his insight into anatomy, which he calls "the sacred genesis that unveils to the human eye the masterpiece of the Creator." He has understood the faults of carriage and their "anatomy," and he has invented a series of incomparable corrective exercises among which span bending takes the first place.

As it is on the trunk that posture depends, and as trunk exercises are the form-giving and corrective exercises proper, there is good reason to include the span bendings in the trunk exercises. But they deserve a place of their own owing to their form, execution and effect. They should not be grouped with the dorsal exercises and only used now and then as one of those. Because of their special value, prominence should be given to them, and they deserve to form a special group. They ought to be included in practically every table, with the exception of tables for little children.

The main effect of span bending is its effect on the shoulders and the dorsal spine.

Span bending is in its action on the shoulders an increase of stretch position, and in its action on the dorsal spine an increase of head pressing backward and high trunk bending backward. Done correctly, span bending will, *better* and *sooner* than any other exercise, produce a good stretch position, one of the most important gymnastic positions, and thereby it will secure good posture of the shoulders. Rightly performed, it can straighten the thoracic curve *better* and *sooner* than other exercises, and that part of the spine most easily avoids being affected, and because of its comparatively small movement it gives the spine its form, and thus the body its carriage.

Span bendings are followed, as a rule, by a complementary exercise, strongly straightening the loin, which in span bending is bent somewhat backward ; examples of such complementary exercises are especially trunk bending forward-downward; hanging, high knee raising; and four standing, knee stretching.

The best apparatus for span bending is the wall bars; the beam, however, can be used for some forms.

A distinction is made between *active* and *passive* span bendings.

A. Active Span Bendings

The proper effect of span bendings depends in a high degree on the correct performance of all details. Even apparently small faults can lessen or completely disturb the effect. Hence these exercises must always be taught with great care.

The exertion of doing span bendings in the right way is increased as the distance from the apparatus is increased because of the greater inclination of the body, which demands more effort to arch the body upward. The greater work falls especially on the muscles pulling back the arms in stretch position. (see pp. 176 and following).

Formerly span bend position was taken from stretch position, 1–4 foot-lengths away from the wall bars by bending the trunk backwards towards the bars. It was, however, very difficult to perform this correctly, especially as the grasping of the bars was generally too low in relation to the distance of the feet. It has now been replaced by angle-hanging span bending, which is easier to perform correctly as the feet are placed at the proper distance in the starting position.

1. **Angle Hanging, Span Bending.** *Back against, to the wall bars—run! Head height (shoulder height)—grasp! For angle hanging feet forward—place!* The body is lowered by a knee bending till the arms are straight; the feet are moved forward and placed on the ground, apart or together, the pelvis is kept against the bars (Fig. 99).

Span bending—1—2. On 1 the body is raised into span bend position, a position in which the body is arched between two fixed points, the hands and the feet. The body is raised principally by the moving back of the arms. As the hands are here the fixed point, and the shoulders the movable point, the movement will lift the trunk forward-upward, raising the ribs and stretching the dorsal spine. Also the correct adjustment of the pelvis influences the arch and increases the tension. For control the position should be examined from the side. The arms and head must form a continuation of the arch of the trunk, only a little of the face should be seen in front of the arms, but an equal amount of forehead and chin (Fig. 100). The chest strongly lifted, the pelvis moved neither too far forward nor too far backward towards the bars, but its inclination so adjusted that the loin is as little bent as possible ; the legs must incline backward towards the wall bars, the more the lower the hands grasp.

The fear that angle-hanging span bending will cause hollow back in girls and women, as their loins have less resistive power than men's, is undoubtedly exaggerated and need not be entertained when the exercise is not introduced at too early an age and when the grasp is not too low, *i.e.*, as a rule, not below head height. The bending of the loin produced by

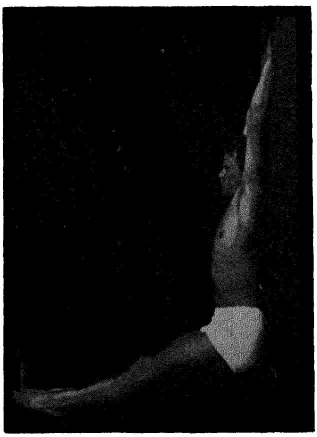


FIG. 99.

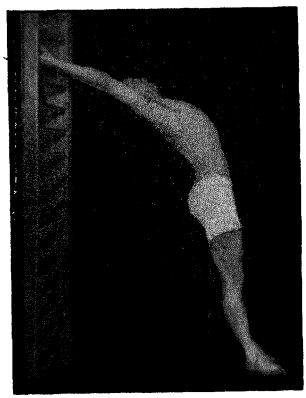


FIG. 100.

span bending is far from maximal, which is shown by Fig. 101, and cannot further hollow back when bendings in the opposite direction, involving active work of the abdominal muscles, are taken. It is assumed that the shoulder muscles are strong enough to lift the trunk sufficiently high. If they cannot do that, the bending of the loin will increase as seen in Fig. 103. If the trunk in that figure were raised sufficiently to bring the arms in stretch position the bending of the loin would be much smaller.

Trained male pupils may grasp lower than shoulder level. During a deep knee bending the arms are raised forward-upward. The bar reached may be grasped (later on, a bar slightly lower) and the legs moved forward. In these vigorous forms of span bending the feet can be placed so far forward that the pelvis in the starting position is 5–6 inches from the bars. This will increase the work for the shoulder muscles concerned and lessen the bending of the loin.

The exercise is made more effective when a heel raising is taken, either together with the movement to the span bend position or by itself in the position.

On 2 the body is lowered to the angle hanging position.

To stretch position—up ! By an even, not too slow, movement the body is raised through span bend to stretch position.

The Importance of Span Bending. Span bending is most easily understood when one bears in mind that it is the stretch position carried further and accentuated (page 176). The effects of stretch position are :—

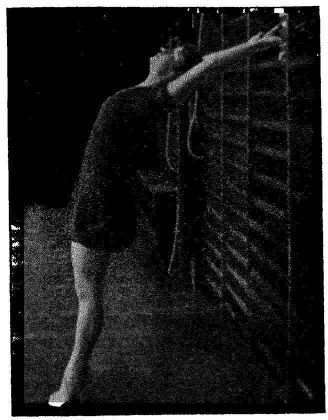


FIG. 101.

(1) A raising of the ribs and by that an increased mobility in their spinal articulation.

(2) A stretching of the dorsal spine and an increased mobility in its joints (the joints between the articular processes and the articulations between the bodies of the vertebræ).

(3) A practising of the correct carriage of the shoulders by a development of the portator scapulæ muscles.

As far as the development of the trunk is concerned, these are the 3 main points to consider when the aim is to produce in the dorsal spine, the chest, and the shoulders, in other words in the "bust," that free and easy carriage and that beautiful and finely-moulded form which makes it the most shapely part of the human body.

Exactly the same effects enumerated under the above 3 points will be found in span bending, when its main effects have to be considered, but here far more dominant than in stretch position.

(1) In span bending the arms are forced strongly backwards ; the upward pull on the ribs and the mobility of the ribs are correspondingly increased.

(2) Of special importance is the effect which span bending has in stretching the dorsal spine and thereby making it more mobile in a backwards direction, because *the dorsal spine determines the carriage, the good one as well as the bad.* A mobile dorsal spine is the basis of good carriage, a stiff one will cause bad carriage.

The dorsal spine cannot be kept mobile unless the dorsal portion of the erector spinæ are kept working and in that way developed and strengthened. If the dorsal spine be mobile and its muscles strong, it will be faultless ; and then the lumbar spine and the cervical spine will be faultless too. The whole spinal column is now "alive" ; no part of it is "dead" and stiff. It has its proper shape, and its carriage will mark all the movements of the body with freedom and ease.

On the other hand, the stiffer the dorsal spine becomes, the weaker the erector spinæ muscles will be ; they atrophy ; and the spine will now be held mostly by its ligaments and the remaining ligamentous parts of the atrophied muscles. Gradually there will be a stretching of this "dead" tissue—"dead" compared to the "living," contractile muscular tissue—the dorsal spine will curve, and the round back will increase as the years go by. The lumbar and cervical spines develop in the same way as the dorsal spine and become stiffer and stiffer. The shape of the whole spinal column suffers and its movements will be marked by stiffness. The movements of the body as a whole lose in freedom and beauty.

But there are still weightier reasons for keeping the dorsal spine, and with it the lumbar and cervical spines, mobile. The mobility is namely of great importance to the organs of the chest as well as to those of the abdominal cavity. A mobile dorsal spine means a mobile chest, making possible freer and deeper breathing and better circulation in the lungs than if the chest had been stiff. By the movements of the mobile back the organs of the abdominal cavity obtain a beneficial auto-massage, and furthermore, the flow of the blood through the two capillary systems will be made easier. The movements of the diaphragm and the abdominal wall, which are important in this connection, are to a great extent dependent on the mobility and carriage of the back.

(3) As regards the shoulders, it is easily seen that span bending has a stronger effect on them than stretch position.

In stretch position the *shoulders* are the fixed parts and the hands are moved. In span bending the *hands* are fixed and the shoulders are moved. In stretch position the muscles involved have to act against the weight of the arms and the resistance of extended muscles and ligaments only, whereas in span bending they have to act against the weight of the body, too, and they work the harder the greater the distance from feet to wall bars is, in other words the more the body is inclining towards the wall bars. This weight increases the muscular work considerably. Even if the arms may be carried into a good stretch position, it does not follow that the muscles of the shoulders are sufficiently strong for the taking up of a good span bend position.

Span bending is an important exercise in producing a good carriage of the shoulders. The faulty carriage here is *round shoulders*, which generally arise together with round back. When the back is rounded, the upper 4 or 5 dorsal vertebræ and the lower 3 or 4 cervical vertebræ are moved forward. From the cervical vertebræ mentioned, the shoulders and arms are suspended as these vertebræ form the origin of portator scapulæ, the strongest part of trapezius. The shoulders will tend to place themselves vertically under their points of suspension. If these are moved forward, as in round back, the shoulders will move forward, too. This will affect the pectoral muscles. Their origin and insertion are now brought nearer together. They will adjust their lengths accordingly; they become shorter and they will fix the shoulders in the forward position. In this case round back is the cause of round shoulders, as commonly found in young people with sedentary work during which they sit with rounded backs. In young people employed in bodily work during which the arms and shoulders are brought forward, the stooping shoulders will gradually pull forward their points of suspension, the lower cervical vertebræ, and in this way cause round back. Most likely cause and effect may be sought in both directions in a vicious circle.

Just as these two faults in posture occur simultaneously, so they are counteracted at the same time. This may be seen from the fact that a person with round back cannot draw his shoulders backward to their proper position if he cannot at the same time straighten his back, and vice versa, the back cannot be straightened without the shoulders going back, too; the suspended and the point of suspension are interdependent.

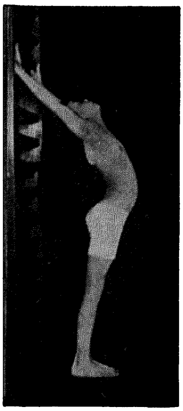
Span bending may do a great deal in correcting round shoulders because it strengthens the muscles that pull the shoulders back, especially the porta scapulæ muscles, and decreases their medium length, and it also lengthens the muscles that draw the shoulders forward when too short, especially the pectorals. Trapezius, in particular porta scapulæ, is made to contract strongly as it rotates the scapula fully in order to bring the arms back as far as possible in stretch position. It works harder the more the body inclines towards the wall bars, i.e., the farther the feet are placed from the wall bars and the lower the hands grasp. The marked moving back of the arms stretches the pectorals and latissimus dorsi; and as they become sufficiently long they do not hinder the shoulders in being drawn back to their proper position. As seen already, there is a *passive* effect also in active span bending. This is also seen clearly in the case of the abdominal muscles. If they are too short they will pull the ribs and the breast bone downward, and thus round the back and straighten the loin too much; consequently they will be passively stretched through span bending. If they are too long, however, they must contract actively during span bending.

It should be noted that as regards several of the points mentioned the movements are very small; in fact, often only an increased tension in the back and the shoulder girdle.

Introduction. Angle hanging span bendings, or span bendings in other standing positions, should not be taken with young children, as they are not able to move their arms back sufficiently powerfully to raise the trunk into a good span bending. Besides, it is difficult to make them avoid too much bending in the loin, which is already very flexible. In general, these span bendings should not be begun till the children are about 14 years old, and they should be well prepared for by the forms of span bending described under C (pp. 225-229). Other exercises that may be looked upon as preparatory exercises for span bending are arm stretchings; arm circlings; low cross reach standing, arm swinging sideways-upward; arm swinging forward-upward; trunk bendings backward; trunk leaning forward combined with arm movements; and front lying.

Common Faults. (*a*) The most common fault in angle-hanging span bending is a drawing back of the feet towards the bars as the body swings into position. This results in the position shown in Fig. 102. We have here only a stretch arch standing position with too much hollowing of the loin. It is evident that if the feet were moved forward to the proper distance the bending of the loin would be diminished.

(*b*) The chest is not raised enough, which means that the arms are not moved sufficiently far backward (and the shoulder-blades rotated outward too little) and the wrists are lowered, perhaps even supported against the bar below. It will be understood from the above that this fault leads to there being absolutely no span bending proper (Fig. 103). This fault may be due either to stiffness in the shoulders (this must be done away with by other exercises) or lack of strength of the shoulder



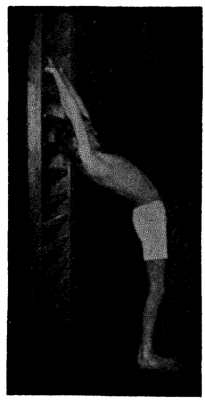


FIG. 102. FIG. 103.

Common faults in span-bending.

muscles (here suitable arm exercises and easier forms of span bending are the remedy).

(*c*) The head pokes forward.

(*d*) The wrists are raised or the wall bars are grasped only with the ends of the fingers, the grasp being loose.

(*e*) The elbows are bent.

(*f*) The knees are bent.

Muscle Work. As it is an important point in taking a span bending that the arms are pushed well backward in a good stretch position, those muscles which turn the shoulder-blade outward must work especially hard—*i.e.*, the *lowest part of serratus magnus and the middle and lower parts of trapezius* (see pp. 177-179 and Fig. 74). As far as the back is concerned, those muscles must work which straighten the curves—*i.e.*, *erector spinæ* must straighten the backward curve in the thoracic spine, and the *abdominal muscles* must prevent too much forward curve in the loin, what they are doing passively when shortened, and actively when prolonged.

2. **Fall Hanging, Span Bending.** Beam head height, later lower.[1] *To the beam—run!* Position is taken half step from the beam and facing. *With undergrip, beam—grasp! Fall hanging—place! Span bending*—1—2. On 1 the body is raised to the span bending position by the arms being moved strongly from the reach to the stretch position. The

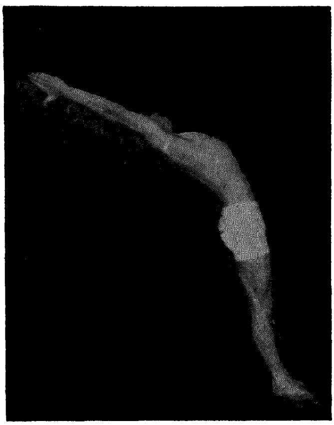


FIG. 104.

FIG. 105.—Back hollowed.

hands are opened and the index fingers supported on the edge of beam, while the thumbs are put against the side of the beam (Fig. 104).

On 2 the body is lowered to fall hanging, the hands again grasping the beam.

Forward upward—swing! The body is raised by the arms through span bend position to the stretch position.

Introduction. For beginners the exercise should be done with the legs apart as in stride standing position, and also when the beam is low. If the feet are not put far enough forward, the loin is hollowed excessively (Fig. 105).

[1] By the height of the beam is understood the height of the upper edge from the floor.

B. Passive Span Bendings

The stretching of the pectoral muscles which is brought about in active span bending is due to the active work of other muscles. However, in many cases this action is too slow or sometimes insufficient. The so-called passive span bendings are then applied, in which the affected muscles are stretched far more strongly as the weight of the body or inertia is utilised (see p. 12). In these exercises there is also a direct stretching of the thoracic curve and of the abdominal muscles.

The passive span bendings should be used for a long time, but together with active span bendings, as it is not enough to stretch the muscles and ligaments which are too short, but the antagonistic muscles must be strengthened at the same time. These active muscles must be contracted as much as the increased mobility allows. In that way they will not only be stronger, but their medium length will be lessened. As antagonists to the short pectoral and abdominal muscles they have so far been too long; in the shoulders this has made itself manifest by round shoulders, in the spine by round back.

FIG. 106.

But it must be noted here that passive span bendings may have a bad effect on pupils who are muscularly slack and very supple. Such pupils should be excused them.

3. Stretch Arch Prone Lying, Shoulder Stretching. Prone lying position is taken in front of and with the head towards the wall bars. During a trunk bending backward the hands are laid across a bar at a level above the floor corresponding to the pupil's suppleness in shoulder and back (Fig. 106).

Shoulder stretching—begin ! The chest is pressed downward as far as possible by even, strong, rhythmical pulling, the movements being neither too quick nor too small. This will stretch the pectorals and latissimus dorsi.

In order to give active work to the antagonists of the extended muscles, the outward rotators of the shoulder-blades, and also to the extensors of the thoracic spine, the hands can be lifted from the wall bar with the arms stretched; if this is too difficult, arm bending can be practised.

4. **Stretch Lean Kneel Sitting, Shoulder Stretching.** Kneeling position is taken at a suitable distance and facing the wall bars. During a knee bending the body leans forward and the hands are supported edgewise on a bar or the wrists are put across a bar at a suitable height, to begin with, head level (Fig. 107), later gradually lower till the arms and trunk approach the horizontal. The more the body leans forward the less bending of the knees and the less lowering of the seat towards the heels.

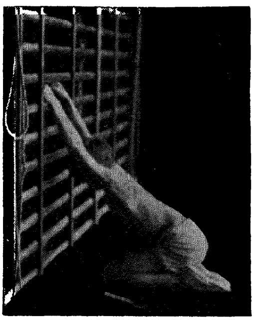


FIG. 107.

Shoulder stretching—begin! The chest is pressed downward as far as possible by even, rhythmical pulling, the movements being neither too quick nor too small. By this the pectorals and the latissimus dorsi will be stretched.

If a pupil, after leaning forward almost to the horizontal, sits back on his heels the loin may be rounded so much that the dorsal spine cannot be straightened; this will consequently hinder shoulder stretching. In very flexible individuals the normal curves may be reversed, not only the loin, but apparently also the dorsal curve; at any rate, in cases like this the movement in the dorso-lumbar junction is so great that it cannot be beneficial, especially not for backs that are undeveloped and muscularly weak. By such unnatural exercises the lumbar curve will be moved upward and the lower 3 or 4 lumbar vertebræ stand as a stiff column not forming part of the curve (compare Fig. 92, p. 203). This does not look well, and it is undoubtedly not good from a physiological point of view.

5. **Stretch (Stride) Lean Standing, Shoulder Stretching.** The exercise is performed as No. 4, but in the standing or stride standing position. Here, also, it is an advantage to begin with only a slight trunk leaning forward and the hands supported in the wall bars at a high level, a little below stretch height. When the hands are supported at or below chest level the feet should be placed so close to the wall bars that the legs are inclined backward. The hands should rest lightly against the

bar; in other words, the position should be nearly the same as ordinary stretch lean standing position without support. When the feet are too near the wall bars it is necessary to grasp the bar; the position will be a kind of hanging position. If, on the other hand, the feet are too far away, one has to rest too heavily on the bar. In both cases muscular activity will interfere with the shoulder stretching.

As in No. 3, it is useful to let passive stretching of pectorals and latissimus dorsi alternate with active work of their antagonists, the outward rotators of the shoulder-blades, and also of the extensors of the back. In order to perform this active work the pupils may, by a slight movement in the ankles, slide back a little till the arms are clear of the wall bars. They are now in stretch (stride) lean standing position, and in

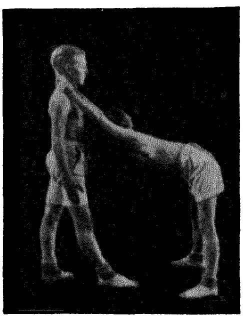


FIG. 108.

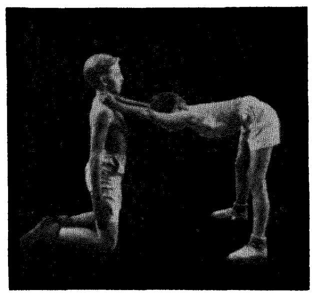


FIG. 109.

this position they may press the arms back in little jerks, perform arm bending and stretching, or trunk bending downward, after which the former position is resumed and the shoulder stretching repeated.

Instead of supporting the arms against the bars, one may take support on the shoulders of a fellow-pupil in walk standing position (Fig. 108), or in kneeling position (Fig. 109). Here it is particularly easy to alternate between passive and active work.

6. **Stretch Back-Support Hanging, Leg Swinging.** Double beam, top beam in high stretch height, lower one an arm's length below. *Top beam overgrip—grasp!* With the back towards the beam, children grasp the top beam with overgrip. Each child gets the beam at the right height by taking more or less distance between the hands, so that the upper part of

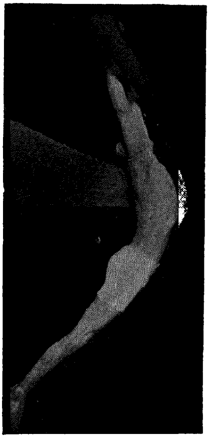


Fig. 110.

the back (shoulder-blades) is supported against the lower beam. The head well back.

The children may also get up into the starting position as follows: They face the beam, grasp the top beam with over-grip, pull themselves over the lower beam and slide into position on its far side.

Leg swinging—begin! Halt! (or *stop!*) The legs, stretched, are swung forward and backward (Fig. 110). As the backward swinging stretches the body very strongly, it must be taken with great care, especially at first. After sufficient practice the swing can be made stronger. The exercise should end with a high knee raising.

With a swing forward—down! Deep jump forward as from stretch hanging position in the wall bars.

7. Passive Span Bending with a Helper. "Ones" take the span bend position at the wall bars.

Twos—ready! "Twos" go under "ones" facing the bars, bend the knees, and grasp with bent arms a bar at low chest height. The back is rounded, the head brought forward, the pelvis moved forward, and the shoulders put under the shoulders of the "ones." Correctly speaking, it is the most prominent part of No. "twos" rounded back that is put against the top of the dorsal curve of No. "one." By the lifting, the dorsal curve of No. "one" will be passively stretched upon the partner's rounded back.

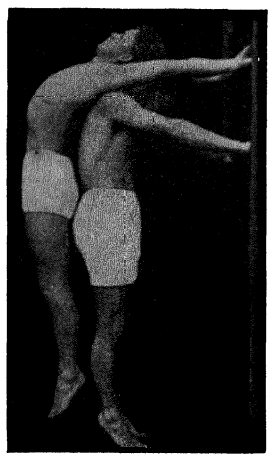


Fig. 111.

Lift! Each in their own time the "twos" slowly and evenly raise the "ones" by stretching the legs and the arms and pushing upward and outward from the wall bars as much as the "ones" can stand (Fig. 111). To obtain the correct effect of the exercise, it is essential that the lifting is done in the proper direction, and this depends on the grasp of the one suspended from the wall bars. The higher he grasps the nearer the vertical his arms will be, and consequently the more obliquely outward he has to be lifted. If he grasps lower, his arms are more oblique and the more upward he then has to be lifted. The proper direction is indicated by the tangent to the circle where his arms are the radius. If the push is directed too much upward the back will slide upward and the pressure will be exerted on the shoulder-joints. This will cause an over-stretching so painful that the pupil suspended must let go his grip on the bar. If the partner pushes too much outward, away from the wall bars, his back will slide down below the dorsal curve of the one suspended, and the exercise loses its value. The effect is increased by the "twos" setting the "ones" in swing by small pushes. The push should be exerted when the legs swing inward; in other words, go against the movement of the legs.

FIG. 112.

On the word *Change!* the partners change places quickly. On *Halt!* all fall in with their backs to the wall bars.

For this exercise a so-called "span stool" (Fig. 16, p. 93) may also be used. With the stool placed properly, the exercise will always have the desired effect as the support here is steady. The height of the stool depends on the pupils. The small ones and those who are stiff must use a lower stool than the bigger pupils and the more supple ones. Suitable heights of stools are 8, 10 and 12 inches. If the gymnasium contains only three stools, one of each height, they may be used by the pupils needing the passive span bending before or after the lesson or during the exercises in squads.

Introduction and Importance of the Exercise. The exercise is first and foremost one for adult pupils as it demands not only willingness but also understanding. Older children, who are well disciplined and keen, may also do the exercise after it has been carefully explained. To begin with it should be taken gently, as otherwise it feels unpleasant. The pupil may lift the partner by putting the whole of his back against his partner's back and then gently withdraw the lower part of his back. The pupils suspended may be instructed to let go their grip on the bar if the exercise hurts them.

Correctly done it is very effective. More than any other passive exercise it may counteract and correct general stiffness of shoulders and back. It contributes therefore greatly to good carriage of shoulders and back, and consequently to good posture in general. Furthermore, it keeps the chest mobile and enables one to breathe deeply. It may be practised by many at a time, and it is a stimulating exercise.

FIG. 113.—X-ray photo of loin and lower dorsal spine.

Here, as elsewhere, an abnormal suppleness should not be aimed at (see p. 5).

A supple back and chest may begin to grow stiff already at the age of 40. Passive span bending is an excellent means of combating the effect of advancing years. If taken fairly regularly it will help to keep the breathing free and easy and have an invigorating effect. Those who are not used to span bending and similar exercises from their youth should take to the exercise gently and begin with the milder forms.—A set of wall bars and a shoulder stool (the so-called "span stool") should form part of the bedroom furniture.

Fig. 112 shows how a father may practise the exercise with his child. Children will soon get to like the exercise so much that they will remind their father of it if he should forget to give it to them. If the child is too heavy to be held in this way the father may stretch it on his back, as shown in Fig. 17, p. 93.

Fig. 113 shows an X-ray photo of the lower 5 dorsal and all the lumbar vertebræ of the child taken in the position shown in Fig. 112.

C. Preparatory Exercises for Active Span Bending

A span bending demands not only mobility of shoulders and spine, but also a certain strength of the outward rotators of the shoulder-blade, *trapezius* and *serratus magnus*, and the *dorsal extensors*. These muscles must therefore have reached a certain development before span bendings proper can be taken.

The outward rotators are trained by exercises such as arm stretchings upward (with stress laid on both stretch and bend position), arm swinging forward-upward, and arm swinging sideways-upward with a pause in stretch position in both cases. These exercises are particularly effective if taken with the body inclined forward as in lean standing or arch front lying position. Also arm circlings and low cross reach standing, arm swinging sideways-upward may be mentioned.

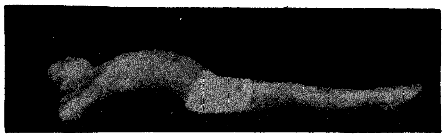


Fig. 114.

The dorsal extensors are trained in exercises such as sitting, and standing, half trunk bendings backward ; stoop standing, and stoop kneel sitting, trunk stretching forward ; front lying, trunk bending backward ; head support hanging, etc.

As children, particularly town children, often have weak shoulder and back muscles, a systematic training by diligent use of such exercises is to be strongly recommended.

But active span bendings may also be led up to by more directly preparatory exercises. A few of these are described here.

8. **Back Lying, Chest Raising.** Back lying position is taken. The teacher then commands : *Back lying, chest raising*—1—2. On 1 the head is pressed so strongly against the floor that the shoulders are lifted and the body is arched upward, resting on the seat and the back of the head only, by a strong contraction of the extensors of the back, especially the cervical and dorsal

parts (Fig. 114). On 2 the body is lowered. When the exercise has been learned it is taken in the ear crook back lying position. When the legs are stretched the *ilio-psoas* will involuntarily help in lifting the trunk and by that it will pull the lumbar spine upward in an arch. This muscle is put out of action when the knees are bent, and that is the reason why crook back lying position should be used as soon as the children can manage it.

To begin with the arms may be kept along the sides, and, if necessary, help in the raising. After that, ear position may be used, one hand resting on the other and the back of the head supported in the palm of the upper hand (compare crook back lying, trunk raising, p. 206).

The exercise may also be performed in such a way that the adductors of the shoulder-blades (especially *trapezius* IIb.), and their outward rotators are trained. The arms are then held in yard position and turned outward so much that thumb and first finger touch the floor, hands lightly closed. During the raising of the shoulders by a pressing backward of the head, the hands are pressed so strongly against the floor that the shoulders are raised a little more, the head leaving the floor. During this the adductors of the shoulder-blades are working hard.

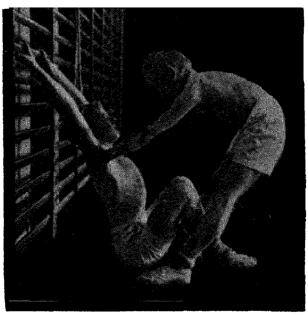


FIG. 115.

The arms may also be held in flight or stretch position by which the outward rotators are trained.

With the arms in yard, flight, and stretch position the exercise is so difficult that only a few are able to do it with the knees bent; it is easier with straight knees.

9. **Crook (Cross) Sitting, Span Bending.** Crook or cross sitting position is taken about 2 foot-lengths from the wall bars and with the back towards them. The trunk falls backward till the shoulders touch the bars, the head bent slightly forward. With the arms almost stretched the bar is grasped, to begin with the hands as far apart as the wall bars allow, later gradually closer together as far as shoulder width. On the command, *Span bending*—1 the body is arched forward from the bars; on 2, lowered again.

In the span bend position No. "twos" may give No. "ones" a passive stretching by standing astride over them, grasping their shoulders either between arms and head or outside the arms, and pulling their chest farther away from the bars by even, strong, rhythmical movements, leaning backward while pulling with straight arms and legs (Fig. 115).

The exercise may be looked upon as a preparatory exercise for back lying span bending or, when active, it is an easier, but, therefore, less effective, form of it. As a passive exercise, however, it is more effective because the partner pulling can utilise all his strength for the passive stretching of the muscles, whereas he in back lying span bending must use part of his strength in lifting the trunk of his fellow pupil.

FIG. 116.

FIG. 117.

Common Faults. (*a*) The back hollowed because the *ilio-psoas* is not kept inactive (Fig. 114).

(*b*) The head bent too far back with the chin poking.

10. **(Crook) Back Lying, Span Bending.** Back lying position is taken with the head 4 to 6 inches from the bars, the hands grasp the 5th or 4th bar, according to size of children; the arms not fully stretched. The teacher commands, *Span bending*—1—2. In the span bending the body must form an arch from hands to seat. The head carried well back as in ordinary span bending (Fig. 116). The exercise is made harder by grasping the 3rd, 2nd, or 1st bar.—When the exercise has been learned it is performed in the crook lying position (Fig. 117). When the legs are stretched, here as in No. 8, the *ilio-psoas* will involuntarily help the arms in lifting the trunk, and the back will be hollowed. When the knees are bent with the heels brought close to the seat, this muscle cannot act and the pelvic inclination cannot increase; hollowing of the back is

therefore out of the question. Just because of that the exercise is an excellent preparatory exercise for span bending proper, and an excellent exercise in itself.—As a complementary exercise one may with advantage use a leg raising sufficiently high to make the feet touch a bar near the hands. Before this is taken the hands should be moved down to the bottom bar and the arms stretched. The knees may be slightly bent as the feet touch the bar, and in this position a knee stretching may be taken on the command *Knee stretching*—1—2. This gives a good stretching of the hamstrings and the loin.

Introduction and Importance of the Exercise. The exercise is learnt most easily by a combination of active and passive work, the pupils helping one another. No. "twos" stand astride No. "ones," who raise themselves as high as they can. No. "twos" then grasp behind their shoulders, so high that the fingers meet near the neck, or they grasp from above between head and arms. No. "twos," while keeping arms and knees straight, lean backward and pull their partner's chest higher and higher forward-upward by even, strong, rhythmical movements. When the highest position has been reached they gently let go their grasp and No. "ones" now have to keep the position gained for a short time before lowering themselves. The exercise is then repeated.

The exercise is most valuable, and stress should be laid on the teaching of it to children from the age of 11 or 12, as well as to adults of both sexes. Its value lies in the considerable work demanded by the outward rotators and the adductors of the shoulder-blade, and this is done by the muscles in a *strongly shortened condition.* As these muscles are often too long and too weak the exercise gives them just that kind of work of which they are in need, and by movements and positions where it is difficult to make faults that might minimise the effect. The antagonists to the above muscles, the *pectorals* and *latissimus dorsi*, so often too short, are stretched at the same time. Consequently, in every respect, this exercise contributes greatly to good carriage of shoulders and chest.

11. Stride Fall Hanging, Heaving through Span Bending Position. Beam at head height, later lower, as far as chest height. *Undergrip—grasp! Feet astride, fall hanging—place! (With a press-off) forward-upward—swing! With a jump arm swinging forward-downward, feet together—place! About—turn! Repeat*—1 (grasp)—2 (fall hanging)—3 (raise)—4 (erect position.

From stride fall hanging position with hands in undergrip the arms are moved quickly from reach to stretch position so strongly that the body without pause is swung through the span bending position up to stretch stride standing position. The less the knees are bent in this move the better, for this lessens the good work of those muscles which move the arms from the reach to the stretch position. The head is held well back in the swing up to stretch stride standing position. The exercise should be repeated several times.

§ 18. Introduction to Trunk Exercises

The lumbar spine connects the lower with the upper part of the body. It is a strong column, mobile in all directions, and in relation to the movements of the trunk it may be compared to the cervical column in its relation to the movements of the head.

The muscles moving the trunk and keeping it firm in all the positions necessary for the occupations of daily life are the extensors of the back and the abdominal muscles. The exercises for developing these are the *Lateral*, the *Abdominal*, and the *Dorsal* exercises.

Young people, particularly young men, are most strongly attracted by exercises demanding skill, agility, and strength. They like competition which these exercises lend themselves to.

The gymnastic system invented for the German youth a hundred years ago by Turnvater Jahn consisted of exercises of skill. They were principally exercises for the individual, feats of skill and strength.

In such exercises principally the limbs are used. They might be called exercises for the extremities or the limbs, a name not used in a disparaging sense but simply to characterise their nature. The exercises performed on the German apparatus, parallel bars, horizontal bars, rings, and trapeze, call upon and develop the arms and shoulders. In vaulting on horse, buck, etc., it is the legs that have to do the work. Jumping and vaulting play a smaller part, however, in the proper German Turn than the other exercises on apparatus. One may therefore be allowed to call the system a system of *arm exercises.*

In England the principal physical exercises are ball games. In these the legs are used chiefly, because running forms the most strenuous part of most games. We may here call the physical exercises *leg exercises.*

Athletics, running, jumping, and throwing, are also to a certain extent exercises for the limbs. The only athletic exercise forming an exception is wrestling, as here not only the limbs have to work hard, but also the trunk itself.

Fortunately, in the German, and also, and to a greater extent, in the English physical exercises a fair amount of work is done by the trunk. Otherwise these exercises for the limbs would be too obviously one-sided. But the effect on the trunk is incidental and not thorough enough to guide growth and secure harmonious development. Furthermore, difficult exercises for the extremities are for the few and gifted amongst adult youth and only for the men. As a basic system of physical education in the school and during the years of growth they are less suitable.

Most one-sided is the German system. Those who have trained hard in parallel and horizontal bars, doing exercises involving the carrying of the whole body by the arms, over-develop their arms, their shoulders, and the upper part of the trunk. Exercises of this kind are unnatural. The legs and not the arms are intended by nature to carry the body.

But those who go in for games only will not secure harmonious development either. Their legs will be strong, but arms and trunk will be neglected. It should be noted, however, that the one-sided effect of games on the body is neither so pronounced as regards physical development nor so undesirable in other respects as the effect of the exercises in parallel and horizontal bars. It is also much easier to adapt ball games to all ages and to both sexes.

One cannot deny that also athletic exercises, running, jumping, and throwing, may have a one-sided effect on the body, especially if they are practised one-sidedly (pole jump always to the same side, throwing the disc or the javelin, or putting the weight always with the same hand, using the same foot always for the take-off in high and long jump). The one-sidedness will be most pronounced when only one of the exercises mentioned is taken up.

Round back and round shoulders, scoliosis, stiffness of various joints, etc., caused by daily occupation and bad habitual postures cannot be counteracted and corrected, nor the bodily harmony regained by these exercises for the extremities.

It is quite natural. It is not the limbs, but the trunk carrying them, that suffers during one-sided work. It is the trunk that will be deformed, and deformity here is more noticeable and more disfiguring than deformity of the limbs.

Attention has been attracted to the fact that young men who are trained with exercises needing hard use of the limbs, especially of the arms, have often considerable faults in their backs. Their backs have become stiff in a greater or lesser degree, and the stiffness is the beginning of the deformation. It is to be supposed that during their training they have neglected to let the development of their back keep pace with the development of their limbs. If that is the case, then it is subjected to injury from the load thrown upon it during the performance of exercises requiring great strength of the limbs. Here is a problem that should be thoroughly investigated.

If gymnastics is to form the body harmoniously, guide its growth, and correct one-sidedness and faults creeping in during development, it must comprise exercises that can affect thoroughly both the muscles and the joints of the trunk.

The ancient Greeks had realised that. Besides athletics they had exercises similar to our gymnastic exercises and aiming at correcting faults in physical development and securing harmony. They had experts, the so-called gymnasts, who superintended the exercises on their palestra, prescribing to each individual the exercises he had to use and how, in order to counteract faults and one-sidedness of development. For the Greeks, lovers of beauty as they were, the aim of physical development for their youth was just as much bodily harmony as bodily strength.

The exercises of the Greeks are forgotten, but P. H. Ling has followed in the footsteps of the Greeks. Amongst the men who revived gymnastics about the year 1800, Guthsmuths, Jahn and Ling, there were none who understood the Greek demand of harmony as Ling did. It was he, therefore, who invented the form-giving part of gymnastics, the exercises for the trunk side by side with the exercises for the limbs. And that is without comparison his greatest gymnastic achievement. His trunk exercises are classical, and have come to stay. They characterise his system, and they have given it its reputation; by them he has made his exercises accessible to all regardless of age and sex, and not only to a few. By them gymnastics has become an educational subject of benefit to all pupils.

Compared to the difficult and attractive exercises of skill and strength performed by the limbs, the trunk exercises are insignificant and not inspiring. They therefore demand a greater pedagogical efficiency and understanding on the part of the teacher.

The rhythmical method of work has proved a great help to the teacher when conducting trunk exercises, as the work becomes more intensive and pleasing when done rhythmically.

By the trunk exercises we wish to influence partly the muscles and partly the skeleton and joints of the trunk.

The *muscles* of the trunk are the *erector spinæ*, running along the back from sacrum and pelvis to the back of the head, and the *abdominal muscles* from thorax to pelvis round the abdominal cavity.

Of the muscles mentioned, the erector spinæ have the hardest work to do during daily life ; they ought to be far stronger than the abdominal muscles, and our gymnastics should provide many and strong exercises for their proper development. Of the trunk muscles they ought to be the strongest, just as the extensors of the hip and those of the knee should be stronger than the flexors of the hip and the knee, the calf muscles stronger than the muscles in front of the lower part of the leg. and the flexors of the fingers stronger than their extensors. Only in that way is harmony secured, for the greater strength of these muscles corresponds to their functions. Just as the exercises for the extensors of the hip and knee and for the calf muscles should outweigh the exercises for their antagonists, so the dorsal exercises should predominate.

The *joints* of the trunk that are of interest are the joints of the spine and the joints between the ribs and the spine.

The joints of the spine, moving together, allow movements in all directions, just as a ball-and-socket joint does. The backbone can bend forward, backward, and sideways and allow twisting round its axis, and these movements may be combined so that we can have a bending and twisting together. The aim of trunk exercises as to the joints of the spine is to preserve this mobility or to regain it if lost.

The exercises moving the spine also effect the joints of the ribs ; but mobility of these joints is best secured by deep breathing, i.e., by taking breathing exercises or exercises that produce strong breathing.

Trunk exercises must prevent any single part of the *skeleton* from being deformed. If the back is kept bent forward or to the side for any length of time, especially during the years of growth, not only will the muscles and ligaments alter, but also the bones themselves; the hard bony tissue is far more plastic than is generally believed (p. 116). In round back, for example, the bodies of the dorsal vertebræ will gradually become wedge-shaped and the spinous processes will be drawn downwards. In scoliosis all the skeletal parts of the trunk will change form: the bodies of the vertebræ, the vertebral arches, the spinous and transverse processes, and the ribs. Trunk exercises counteract a tendency to round back and scoliosis, and thereby prevent the deformities taking place.

Some trunk exercises make the muscles work strongly in *static* contraction, holding the trunk in certain positions, such as lean position in trunk leaning forward, front hand lying, and side hand lying. Other trunk exercises make for *suppleness* in the joints of the back by extensive movements such as trunk bendings backward, forward-downward, side bendings, and trunk twistings.

As starting positions for a number of trunk exercises the so-called *localising sitting positions*—cross-, crook-, long-sitting positions—are used greatly at present. The object is to avoid and counteract hollow back, of which some have an exaggerated fear.

In the sitting position the pelvic inclination is lessened, the sacrum is vertical and sometimes even tilted backwards—for example, in crook sitting position and especially in long sitting position if the hamstrings are short. The lumbar spine must then go vertically upwards or its curve may even be reversed. In the sitting positions mentioned, not only the sacrum but also the lumbar spine, mostly the 3 or 4 lower vertebræ, are fixed, and the spine is kept so fixed that it hardly takes part in the movements of the trunk.

When sacrum and lumbar spine have been fixed thus a high trunk bending backward will be performed in the right locality, *i.e.*, the dorsal spine, even by little children and beginners. The dorsal curve will be straightened as much as possible, and the proper muscles, the dorsal extensors, will work. The joints of the dorsal spine are those that first lose mobility in civilised life because of lack of use. Bendings backward are unconsciously performed in the more mobile loin. Even little children may have dorsal curves that cannot be stretched to the normal. On the other hand, it is seldom the dorsal spine has lost its ability to bend forward, to increase the curve.

When the dorsal spine has lost its mobility, one is not able to control its extensors as one controls the extensors of the neck, or of the loin, or all other muscles of the skeleton. The proper use of these muscles is only regained by exercises in which they are used, such as trunk stretching (*i.e.*, high trunk bending backward) in sitting position. Here it is impossible to transfer the movement to the loin ; it *must* take place in the dorsal spine and the dorsal erector spinæ must work.

It is this stretching of the back more than anything else that justifies the use of the localising sitting positions. The normal suppleness of the dorsal spine is of importance for the mobility of the ribs, accordingly for the breathing, and also for the carriage and the free and easy movements of the spine, for example, in walking. These starting positions are also useful when teaching children and beginners the full twisting in a trunk twisting, or in side bendings the proper bending, including a bending of the dorsal spine. The movements are fairly small, but they are localised to those joints that most easily avoid being affected ; as they are carried to the extreme limits, too, they make both for mobility and muscular development.

But the use of the sitting positions should not be overdone. They are loose and unstable, and, therefore, do not allow energetic work of the bigger muscles of the trunk. In side bendings the supporting area sideways is only equal to the distance between the ischial tuberosities, *i.e.*, about 4 inches. Only a small side bending can be taken before the body tilts over. In trunk twistings one cannot help turning on such a small area, and by arm exercises, done with swinging or flinging backward in these sitting positions, the upper part of the trunk must be drawn forward by the abdominal muscle, as otherwise one falls back, the tuberosities not giving the same steady support in a backward direction as the foot with the heel directed backward. As the hip joints as a rule do not allow sufficient bending, this forward movement will be accompanied by a rounding of the back. In a trunk leaning backward with straight back the legs will soon be tipped up so the work here for the abdominal muscles and the flexors of the hips will be only slight.

For another reason the sitting positions should be used sparingly. The hip-joint is surrounded by greater and smaller muscles moving it and regulating its movements. In the sitting positions the hip-joints take no part in the movements of the trunk during side bendings, trunk twistings, and trunk bendings backward and forward. But it is important to develop strength and co-ordination of all these muscles. It is they that balance the trunk on the heads of the femurs ; and this balancing work is required in so many of our movements, *e.g.*, every time we take a step in walking or running ; we notice this by fatigue of these muscles if we have walked some distance on a slippery surface, *e.g.*, on the ice. Standing trunk exercises ensure a development of these muscles as regards strength and co-ordination which should not be under-estimated. Formerly, this was not realised ; many even thought that the movements in the hips detracted from the value of the exercises, no doubt due to the fact that movements such as trunk twistings and bendings were often badly performed, the spine was hardly affected, whereas the greater part of the movement took place in the hip joints. When the movements of the spine are carried to their limits it is only an advantage that the hip-joints are moved too, it gives the movements a wider range and increases the muscular work.

But there is a fact of far greater importance that tells against an extensive use of the sitting positions. When the lower 3 or 4 lumbar vertebræ are kept fixed, and the lumbar spine straight, the movements of the trunk will take place especially in the dorso-lumbar junction. The spinous processes are here short, the last two pairs of ribs are free, and these facts, together with the shape of the articular processes, make this junction very mobile. If the lower part of the lumbar spine cannot take part in the movement it must take place in this "critical" region, and we run the risk of exaggerating its mobility. The lumbar curve may even be transferred upward to this region (Fig. 92, p. 203). In backs like that the 3 or 4 lower vertebræ form a straight, stiff column, from a physiological point of view undoubtedly undesirable and ugly.

The sitting positions may be used when the exercises are being introduced and as an aid for the pupils to the correct use of the muscles of the back, but the training proper of the muscles must be done in standing positions.

As it has been explained, trunk exercises are capable of developing the trunk properly as regards form and mobility, and this is of obvious value.

But they are of hygienic value, too, by their effect on the organs of the chest and the abdominal cavity. By keeping the thorax mobile and training its muscles, they enable one to inhale and exhale deeply, and this is beneficial to the organs of breathing and circulation. The kneading or massage which they give to the abdominal organs increases the circulation in them, furthers their development during years of growth, and benefits their functions (compare pp. 280 and following.

It should also be noticed that whereas many exercises have to be given up as the years advance, trunk exercises may be practised throughout life; and the older one grows the more necessary it is to stimulate the functions of digestion, breathing and circulation. One should make a habit of spending 1 or 2 minutes daily on trunk exercises, *e.g.*, in the morning before dressing.

Trunk exercises are divided into *one-sided* and *double-sided* exercises.

The one-sided ones are called *Lateral exercises*. Here the work is done alternately by the muscles of the left and the right side. In trunk twistings, which are also grouped with the lateral exercises, certain muscles on one side work together with others, not the corresponding ones, on the other side, so also this work is one-sided.

The double-sided trunk exercises are divided into *Abdominal exercises* and *Dorsal exercises*. The corresponding muscles of both sides are here working together, in the abdominal exercises, chiefly the abdominal muscles, and in dorsal exercises, chiefly the dorsal muscles of the spine (*erector spinæ*).

Trunk exercises may also be grouped as to whether they affect *joints and muscles* or *joints only*. In the first case the muscles are working concentrically and excentrically, moving the joints of the back. In the latter case the muscles are in static contraction, holding the body in certain positions without moving the joints.

This latter grouping would, however, be somewhat confusing in the arrangement and description of the various trunk exercises as exercises varying greatly in character would be mixed, and as regards the other exercises, a grouping of this kind would be impracticable. But it is not necessary either, as it is easily seen whether an exercise causes concentric, excentric, or static muscle work.

In the following, the trunk exercises are arranged according to certain common characteristics. All side bendings, for example, form one group, all front hand lyings another, etc.

§ 19. Lateral Exercises

Lateral exercises mainly develop the oblique abdominal muscles, and also partly the back muscles (*erector spinæ*), especially *semispinalis* and *rotatores*. They train mobility sideways in the spine and its power of twisting on its own axis. By this they contribute greatly towards mobility of chest, and are of great import for the equilateral development of the body.

There are very few movements in daily life which are symmetrical—that is to say, which use both sides of the body quite alike. Most are one-sided, not only in that the one side alternates with the other in doing the same work (for example, in walking and running, but much more often in that each of the sides regularly performs its different part of the work independently of the other—for instance, in cutting, sawing, planing, digging, reaping, throwing, etc.

Everyone knows how from childhood we have habitually used one hand and, because of that, one side more than the other. This one-sidedness affects the spine, as it adapts itself to every one-sided movement and position; in other words, the back is made "scoliotic" by bending sideways from its normal vertical position in one or more places. If, then, we continually take the same one-sided movements, the muscles and ligaments of the back will adapt themselves accordingly and the spine will lose part of its ability to conform to the opposite movements; then it will no longer be able to bend with equal ease and equal distance to both sides, and it will be on the way to becoming scoliotic permanently. Many faults in the back, much stiffness, much ugly and one-sided development might be avoided if one trained oneself to use the one side, the one hand, the one foot as well as the other during one's daily occupation. In gymnastics we try to make up for this one-sidedness in daily life by following the *invariable rule* of demanding that a one-sided exercise must be performed as often and as strongly to the one side as to the other. But the few hours of gymnastics are not able to counterbalance the influence of many hours' daily work.

Harmonious and plastic movements are closely connected with the ability of the spine to bend equally to both sides. Even a small curvature, and its accompanying stiffness, immediately causes the movements of the body to be less natural and beautiful, *e.g.*, in walking ; and a deformity in the spine, as a rule, disfigures the body more than a deformity in any other part of the skeleton. As lateral exercises to a great extent help to keep the spine equally supple towards both sides, they are of service in preventing scoliosis, and, therefore, are of great value in maintaining the beauty of the body.

Lateral exercises have a very beneficial effect also on the digestive organs (refer to p. 280), as they give an effective "auto-massage."

A. Trunk Twisting

In trunk twisting there is a twisting in the dorsal and lumbar spine. The twisting is greatest in the lower dorsal and upper lumbar region and becomes less both upwards and downwards.[1] With the pelvis fixed, *e.g.*, in the ride sitting position, a twisting amounting to about 120 degrees may be found in supple and trained individuals ; in those who are stiff and untrained it is considerably less.

In ordinary daily life the spine is hardly ever twisted to its limits. Unconsciously part of the turning is done in the hip-joints, which we see by the movements of the pelvis. In a twisting to the left there is an inward rotation in the left hip-joint (very large if the right heel is lifted and the right knee is bent) and an outward rotation in the right. The more the pelvis is turned the more the pupils are tempted to neglect the twisting of the spine, which is the essential part of the exercise. Here, as elsewhere, in order to produce mobility the joints must be moved to their limits and worked hard in these positions. But we cannot reach the limits unless the pelvis is fixed. As long as the pelvis moves, the origin and insertion of each muscle taking part in the twisting is loose, and conse-

[1] I. H. Braus, in his "Anatomie des Menschen," I, 1921, says about the articulating surfaces of the dorsal articular processes that they are spherical with the centre of the sphere lying in front of the spinal canal. In the lumbar vertebræ they form part of a cylindrical surface, the axis of which lies behind the spinal canal. The lower articular processes articulate with the upper processes of the vertebræ below like a cylindrical projection fitted into a hollow cylinder (as in a hinge). The shape of the articulating surfaces shows that a twisting may take place between the lumbar as well as the dorsal vertebræ.

quently it cannot contract with full strength; that can only be done when either origin or insertion is fixed.

The starting positions used for fixing the pelvis in trunk twistings are partly *sitting* and partly *standing* positions in particular.

In *sitting* positions, such as crook, long, cross, kneel and ride sitting positions we try to fix the pelvis in the erect position, so that it does not take part in the movement. The twisting takes place entirely in the spine.

In *standing* positions, such as erect, close, stride, oblique and walk standing positions the pelvis takes part in the movement to begin with, as there is a rotation in the hip-joints. But when no further movement is possible there, and if the feet are kept firmly on the ground, the muscles and ligaments of the hip-joints will fix the pelvis, and the muscles that perform the twisting will now have a firm base to work from and the twisting can be carried out fully.

From a theoretical point of view, it might seem of minor importance whether the twisting is carried out in a sitting or a standing position; in other words, whether the pelvis is fixed before the twisting begins or whether it shares in the first part of the movement. But in actual practice there is a considerable difference.

In the sitting positions the only movement is a twisting of the spine so the range is small. The momentum of the body means very little, particularly as the sitting position is not very stable; the body turns easily on the ischial tuberosities; arm flingings and swingings, so effective in the standing positions, can be used to a small degree only and without any vigour in the sitting positions.

To this may be added that in these positions all movements in the hip-joints are excluded; consequently, the training in strength and co-ordination of the rotators of the hips, which they get in the standing positions and which should not be neglected, is out of the question (see pp. 234-235). The muscles round the hips play a great role in the control of the body; we move in the erect position, and it is in that position the full control of the body should be acquired, and it is here it should manifest itself.

In standing trunk twistings, the aggregate muscular work is far greater than in the sitting twistings; the greater range of movement makes the exercises more effective as regards suppleness and more stimulating to the circulation, especially in the abdominal organs. They are generally more invigorating and enjoyable, too.

From the above it will be seen that it is the standing positions one should use chiefly in trunk twistings. But the sitting positions have certain advantages. Trunk twistings carried out in sitting positions are *preparatory exercises* to the standing trunk twistings. Beginners and children, who do not understand how to use properly the muscles concerned, are made to do so in the sitting positions. When sitting, the movement must take place in the spine and must be performed by the proper muscles. Also in the sitting positions the back will be kept straight, and a hollowing of the back, so common in the standing positions, will be out of the question if the positions are correct and are kept up during the twistings.

The movements of the pelvis are not equally free in all the starting positions. The following positions are arranged in such an order that the pelvis will be more and more fixed: standing, close standing, stride standing, oblique standing, walk standing, kneeling, crook sitting, long sitting, cross sitting, kneel sitting and ride sitting positions.

Stride standing position is the best and the one most commonly used. The pelvis is allowed to move part of the way, and the position is so steady that one can put all vigour into the twisting itself, and also into the accompanying arm movements, which serve to increase the degree of twisting. The greater the distance between the feet the less does the pelvis take part in the movement, but the accompanying arm movements may still be performed with vigour because of the steadiness of the position.

Oblique standing, and especially *walk standing positions*, also fix the pelvis well, but only as regards twistings towards the side of the front foot. When the left foot is in front the left side of the pelvis is moved a little forward, and during the twisting the pelvis is kept in position by the rear leg. The range of the movement in those two positions is much smaller than in stride position, and they are not nearly so stable.

Crook sitting, long sitting and *cross sitting positions* are used by some teachers more than they deserve to be. The positions are too loose, the trunk turns so easily on the ischial tuberosities, especially if quick arm movements are added. These deficiencies may be lessened by putting the right hand on the left knee in a twisting to the left, and vice versa, as this will make the position firmer.

Kneel sitting position is very useful, particularly for children. It does not require apparatus, as ride sitting does; it can therefore readily be taken, and it is a fairly firm position in which one can work vigorously.

In *ride sitting position* the pelvis is very fixed, but only if the knees are pressed firmly against the apparatus; and children often forget this.

In all the standing and sitting positions the lower part of the body is more or less fixed and the upper part is moved. In an exercise such as back angle lying, leg swinging (p. 249) the lower part of the body is moved and the upper part is fixed. The action of the muscles concerned is reversed.

In most exercises a weight has to be lifted as we either raise or lower the whole or parts of the body (*e.g.*, in bendings and leanings of the trunk, in knee bendings, jumping and vaulting, heaving exercises, etc.). In trunk twisting with the body held vertical there is no weight to raise or lower, the various parts of the body are moved in a horizontal plane. Here the muscles only have to start the movement and to overcome the resistance from the various tissues, exert the greatest possible tension on the antagonistic muscles. The greatest, almost the only real, work is found at the end of the movement, and therefore it is important to carry out the movement fully. But even then the exertion is not great; one is able to keep at these exercises for a long time without fatigue. Nevertheless, they are very valuable and should form part of every gymnastic lesson. They contribute greatly to the mobility of the spine, and they give to the abdominal organs a massage (auto-massage) stimulating to their circulation.

As each trunk twisting must be repeated many times, they lend themselves very well to the rhythmical method of work.

1. **Wing (Bend, Across Bend, Yard, Ear) Stride Standing, Trunk Twisting [Wing (Bend, Across Bend, Yard, Ear) Stride Twist Standing Position].** *To the left—twist!* Firstly, the pelvis is turned to the left as far as possible by a movement in the hip-joints, feet firmly on the ground, knees fully stretched, trunk vertical and resting equally on both legs. Afterwards, when the pelvis cannot move any further, the trunk is twisted slowly as far as possible to the left, the body being kept well stretched, shoulders back, head in the relative erect

position. In the twist position the effect may be increased by pulling energetically with small jerks. By this the suppleness of the spine is further increased, and the muscles concerned have greater work to do in order to overcome the tension of antagonists and ligaments. Beginners, especially children, may here be allowed to turn the head, too.

Forward—twist! The body is turned to the front. The teacher may also command *To the right—twist!* on which the body is twisted round to the right.

The exercise may be done quickly in 2 movements, *i.e.*, from side to side: *Quick trunk twisting to the left*—1. *To the right*—2. *Repeat*—1—2.

As soon as the exercise has been learnt the teacher should adopt the rhythmical method of work as the most effective. *Quick trunk twisting—begin!* To begin with, individual rhythm is used (p. 48), and the twistings should not be maximal at once; the correct form is best obtained by smaller movements. But soon complete movements taken in joint-rhythm are adopted. The movements should not stop with a jerk caused by a sudden muscular contraction; they should be stopped by the tension of the muscles that are stretched to the limit of their elasticity. This will give the movements their right character; they will be even and springy, and they will be carried out to their full limit.

The pupils should often be reminded to keep their feet firmly on the ground. Now and then they should make a stop in the twist position in order that it may be controlled and in order that the muscles may work in the most shortened condition. This latter is best obtained by little jerky movements in the twist position.

A slow and good trunk twisting may be taken from wing or ear position, the left arm during the twisting being carried to yard position, and the head turned. From wing position the arm should be stretched slowly downward to the side before being raised sideways; from ear position the hand describes a curve upward and sideways. The arm movements are suited to the twisting and finish with it.

Common Faults. (*a*) The feet are not kept firmly on the ground.

(*b*) In twisting to the left the right knee is bent, the right shoulder is advanced, and the head is turned to the left; the weight of the body is transferred to the left leg.

(*c*) The back is hollowed and the head falls forward.

Muscle Work (Fig. 118). In a trunk twisting to the left the chest is drawn to the side above the left hip-bone, which may be considered the fixed point, by the *obliquus internus abdominis* of the left side, and the *obliquus externus abdominis* of the right. These two muscles are in continuation of each other from the left hip obliquely upward over the body to the ribs of the right side. Also the deep layers of the muscles of the back are

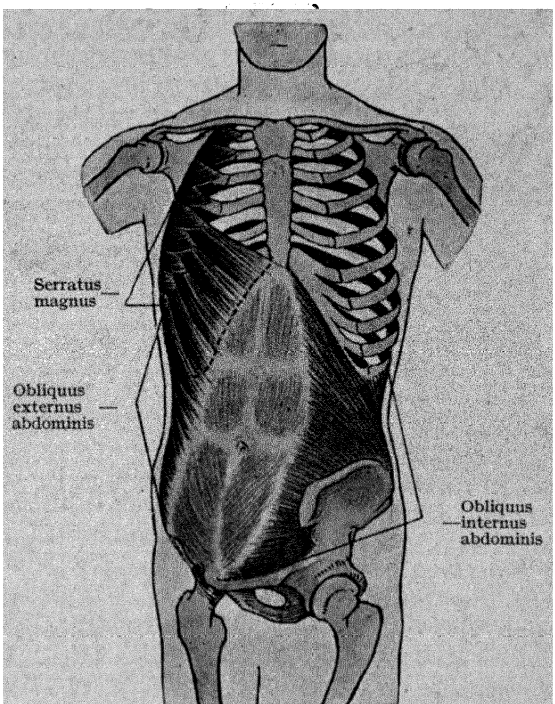
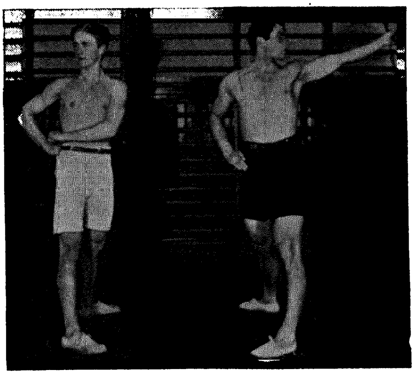


FIG. 118.

working: on the right side the *dorsal rotators* (horizontally from transverse to spinous processes), *multifidus* and the *dorsal semispinalis* (also from transverse to spinous processes, but their fibres skip from 3 to 6 vertebræ).

In the left hip-joint there is an inward rotation performed by the anterior parts of *gluteus medius* and *minimus* and by *tensor vaginæ femoris*. In the right hip-joint an outward rotation is brought about by *gluteus maximus*, the posterior parts of *gluteus medius* and *minimus*, *pyriformis*, *obturator internus*, *gemelli*, *obturator externus* and *quadratus femoris*. The small muscles of the hip-joint are trained by the movements of the hip accompanying trunk twistings, side bendings, balance exercises, walking, running, jumping with single take-off, etc. (compare p. 234-235).

2. **Wing Stride Standing, Trunk Twisting with Single Arm Swinging Sideways.** *With single arm swinging sideways, trunk twisting—begin!* To increase range and momentum the exercise begins with a "start," that is, in the case of trunk twisting to the left a twist to the opposite side, while the left arm from wing position and slightly bent is carried to the front of the body (Fig. 119, a). Without any pause one twists from this to the other side with an energetic but not too sudden pull, the arm at the same time swinging to yard position slightly above shoulder level (Fig. 119, b). When the twisting movement stops, the momentum of the arm will add a passive trunk twisting to the active one and rotate the trunk a little further. It is important to note that the trunk should set the arm in swing, and not vice versa, because a vigorous arm swinging caused by the arm muscles requires a fixing of the trunk from where the muscles come, and this fixing will impede the trunk twisting.—The exercise should be practised a fair number of times to the left before changing to the right. Occasionally one should pause in the twist position so that it may be examined and corrected, and for the performing of small energetic pulling movements in the position. During these latter the shoulder-joint must not be moved; the pulling must be produced by little twistings of the trunk. If the arm swings separately, the trunk will have to be fixed, and the pulling will therefore only influence the shoulder by stretching the pectorals; the trunk twisting will not be increased.



a FIG. 119. b

There is a fine rhythm in these large, springy and yet energetic movements. The exercise lends itself to work in joint-rhythm. It is an effective and invigorating exercise.

Common Faults. As under No. 1. Further, the arms are swung sideways below shoulder level or too obliquely upward, in both cases losing in effect as regards the twisting of the trunk.

3. **Across Bend Stride Standing, Trunk Twisting with Single Arm Flinging Sideways.** *Left foot sideways—place! Arms across—bend! With single arm flinging sideways, trunk twisting*—1—2. On 1 the trunk is twisted rather quickly as far as possible to the left; the left arm is flung to yard position principally by the quick twisting of the trunk, as in No. 2. On 2 the movement is repeated to the right. The head is turned too, so that the eyes follow the movements of the arm.

As in exercise No. 2, pulling movements may be performed in the twist position.

When the exercise has been perfectly grasped, it should be performed rhythmically from side to side. Done in this manner, it is the best and most effective of all standing trunk twistings.

Common Faults. As under Nos. 1 and 2.

4. **Reach Stride Standing, Trunk Twisting with Single Arm Swinging Sideways.** From reach stride standing position with the palms of the hands together rhythmical trunk twistings from side to side are taken. In a twisting to the left the right hand slides quickly along the left arm from hand to shoulder, and by its pressure it increases the speed of the swing of the left arm to yard position, so that the momentum of the arm may help the trunk well round in the twisting. Reach position as above is resumed and the movement is repeated to the right. As the hands pass through reach position they may be clapped together. But this implies a danger that the children may think more of the clapping of the hands than carrying out the exercise to its limit.

5. **Stride Twist Standing, Trunk Twisting with Free Arm Flinging.** In stride standing position the trunk is twisted to the left; left arm is placed on the back with the hand close to the right hip, right arm in front of the body with the hand on the left hip. From this starting position quick and vigorous trunk twistings from side to side are taken, each arm flung in a curve and round to the other side. The arms are kept loose and slack, and the more vigorous the twisting the higher they are swung in the curve. By the momentum of the arms the twisting is carried a little further than would be possible by the active twisting alone.

6. **Cross Sitting (Long Sitting), Trunk Twisting with Free Arm Flinging.** Like exercise No. 5, but performed in the cross or long sitting position. A pause may be made in each twist position while the hands tap lightly on the floor, or the twistings may be kept going without any pauses so that the arms are kept swinging without being lowered.

The exercise may also be done in *kneel sitting position*, which is somewhat firmer (Fig. 120). In this position the hands cannot reach the floor; they may be flung round the body as in exercise No. 5, or with beginners kept in wing position.

7. **Bend Stride Twist Standing, Arm Stretching Upward (Stretch Stride Twist Standing Position).** *Left foot sideways, arms—bend! To the left—twist! Arm stretching upward*—1—2. *To the right—twist! Arm stretching upward*—1—2. *Forward—twist! Left foot inward, arms downward—stretch!* The exercise may with advantage be taken in such a way that the arm stretching is done simultaneously with the trunk twisting.

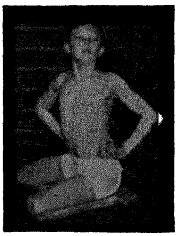


FIG. 120.

Common Faults. As given under 1. In addition, in twisting to the left the right arm is stretched obliquely forward so that the arms are not parallel.

8. **Wing (Ear) Walk Standing, Trunk Twisting [Wing (Ear) Walk Twist Standing Position].** *Left foot forward, hands on hips—place! To the left—twist! Forward—twist! Feet—change! To the right—twist! Forward—twist! Right foot inward, hands—down!*

Common Faults. As given under 1. In addition, right elbow comes forward in twisting to the left.

9. **Wing (Ear) Ride Sitting, Trunk Twisting [Wing (Ear) Twist Ride Sitting Position].** Stools or benches. The pupils are arranged facing the apparatus.

Left leg over, ride sitting—place! (or *down!*). If ride sitting position is taken on a stool, the heels must be pressed against the rear foot of the stool; if a bench is used, the feet must be on the floor vertically under the knees. In both cases the knees must be pressed firmly against the apparatus, as it is that alone which fixes the pelvis.

Trunk to the left—twist! Forward—twist! and so on. *From position—up!* The leg which was thrown over the stool when the position was taken is now brought back, and the erect position is taken.

In this trunk twisting the pupils, especially children, commonly forget to press the knees firmly against the apparatus. Consequently, in a twisting to the left the left knee moves with the body and leaves the apparatus. But this makes the position loose and instead of a twisting, a turning on the ischial tuberosities is performed. In order to fix the pelvis it is useful in a twisting to the left to grasp the left knee with the right hand, as the hand then will help to keep the knee against the apparatus. Quite naturally the stronger the twisting the stronger the hand will pull on the knee. The same holds good for crook, long (Fig. 121), cross and kneel sitting trunk twistings.

From wing position the left arm may be moved out to a high yard position during a trunk twisting to the left, the right hand grasping the left knee, the head turned so that the eyes follow the movement of the arm. Pulling movements may be performed in the twist position to increase the effect of the twisting. This pulling, in this as in other similar starting positions with the arm in yard position, should be done by small energetic twistings in the extreme position. The shoulder-joint must be kept stiff so that the arm swings with the body, and by its momentum increases the twisting. It is commonly seen that the arm swings separately by small movements in the shoulder-joint. For such movements, however, the trunk has to be fixed, therefore they cannot contribute to further trunk twisting.

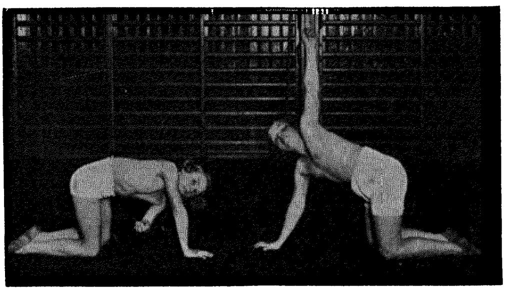
FIG. 121.

Common Faults. As under 1. In addition, during a twisting to the left the left knee will leave the apparatus, so that the pelvis is turned.

10. Prone Kneeling, Trunk Twisting with Single Arm Swinging. The children lie on hands and knees, knees a foot-length apart, hands close together and so far from the knees that arms and thighs are vertical. *Trunk twisting with arm swinging*—1—2. On 1 the trunk is twisted to the left and the left arm swung to vertical position (Fig. 122, b); on 2 the trunk is twisted to the right, the left hand put on the floor, and right arm swung into vertical position.

When the exercise has been taught by numbers it is done rhythmically. It is best to take a number of twistings to the one side before changing to the other. In order to make the movements large, the swinging arm may be brought well down under the body with the shoulder lowered (Fig. 122, a). This will make the arm swinging more powerful and increase the twisting.

Now and then the children are made to stop in the twist position; the teacher corrects and sees to it that the arm is brought to the vertical and that the body is not drawn backwards towards the heels, which will make the exercise less effective.



a FIG. 122. b

The axis for the twisting does not, as in other trunk twistings, go through the spine, but from the pelvis to the shoulder-joint of the supporting arm. The position of the pelvis is not very firm, it is displaced somewhat from side to side during the movements. From these two facts it is clear that there is not a full twisting of the spine in this exercise. The exercise makes for suppleness in the shoulders as the pectorals become stretched.

With little children the exercise may be taken in *prone kneel sitting position.* The trunk is here held obliquely forward, the hands touching the floor lightly, as only a small part of the weight of the body is supported by them.

11. **Reach Stride Lean Standing, Trunk Twisting with Single Arm Swinging Sideways.** From stride lean standing position with the arms hanging loosely down, the trunk is

twisted quickly from side to side, left arm swinging to yard position in a twisting to the left and right arm swinging across the chest (Fig. 123). The arms must swing in a vertical plane. To see whether that is complied with the teacher may call a halt in the twist position. The one arm should then point vertically upward even if the body cannot be moved right down to horizontal position with straight back. In the latter case the arm is a little above shoulder level in the relative yard position.

In the lean position the lumbar extensors of the back work so strongly that they fix the loin and almost prevent it from taking part in the movement. This takes place in the dorsal spine chiefly. The exercise makes the shoulders supple, too, as the vigorous swinging of the arms caused by the twistings stretches the pectorals.

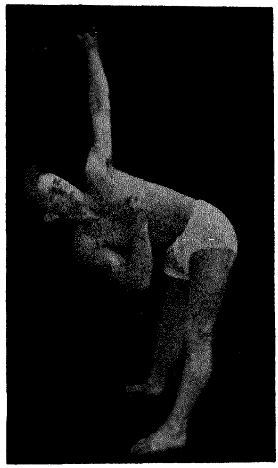


FIG. 123.

12. **Ear (Flight, Yard) Back Angle Lying, Leg Swinging Sideways.** No. "ones" lie on their backs with the hands in ear position and the legs raised vertically. No. "twos", standing or kneeling behind them, lean forward and place the hands on their elbows. *Leg swinging*—1—2. On 1 both legs are swung sideways to the left down to the floor. During this movement No. "twos" must press their partners' right elbows firmly against the floor. On 2 the legs are swung through the vertical position over to the right side ; it is now the left elbow that has to be held firmly against the floor.

The exercise may also be taken at the wall bars, the pupils grasping the bottom bar. Only every other section of the bars is occupied, the pupil lies on his back at such a distance that he can grasp the bottom bar with the arms in flight position (Fig. 81, p. 188). The arms keep the shoulders against the floor and the legs swing from side to side in joint-rhythm.

In yard back angle lying position the exercise may be done without support. In the swing to the left the *left* arm must be pressed firmly against the floor in order to prevent the body from rolling over.

If No. "ones" and "twos" lie head to head in continuation of one another and with their arms in flight position, they may grasp one another's hands. When they swing their legs to their own left simultaneously they are able to steady one another well.

The exercise is fatiguing. Beginners may therefore swing their legs with the knees bent, as this makes the exercise easier.

The legs are here raised and lowered so the active muscles have a considerable work to do in each twisting, and in that the exercise differs from the trunk twistings with the trunk vertical, as mentioned on p. **241**. It should therefore be used fairly often.

Common Faults. The legs are lifted higher than to the vertical position and this makes the exercise easier.

B. Trunk Bendings Sideways

Trunk bendings sideways are the most effective gymnastic exercises for counteracting the one-sided work and the faulty postures of daily life and the inability to bend equally far and with equal ease to both sides, which is a consequence of that. They are accordingly very important exercises, and they should form part of every gymnastic lesson.

A trunk bending sideways can hardly be performed as a pure side bending. As a rule it is accompanied by a twisting. The vertebral bodies turn to the convex, the spinous processes to the concave side of the arch of the back.[1]

This twisting explains why the pupils are inclined to hollow the loin in a side bending ; the twisting tends to add a slight backward bending to the side bending. The more the spine

[1] The reason for this is not clear. It is supposed that the vertebral arch, with its three muscular processes and four articular processes, is more bound than the vertebral body, and that this latter accordingly is more easily moved a little. An additional reason is perhaps this, that the parts of the erector spinæ nearest the spinous processes press on these when they are contracting in a side bending, a pressure to which the vertebral bodies are not subjected. Accordingly, in a side bending to the left, the erector spinæ of the right will hold back the spinous processes because of their tension, whereas the vertebral bodies move slightly towards the convex side of the spine, *i.e.*, each vertebra turns slightly with its spinous process towards the left and the body towards the right.

In scoliosis, which may be considered a permanent side bending, the line formed by the spinous processes makes the back appear less scoliotic than it is because the spinous processes have been turned towards the concave side of the arch. A scoliosis in the loin in its first stage will, therefore, not be detected by looking at the line of spinous processes ; one must examine the contours of the waist and their relation to the arms.

is allowed to twist and the more a bending backward is added, the greater the work for the abdominal muscles, and the less for the extensors of the back.

In side bendings with difficult arm positions one is apt, however, to twist to the other side, *i.e.*, to the left, in a side bending to the left, especially if the abdominal muscles are not very strong. Now a forward bending is added to the side bending and the work for the abdominal muscles is diminished, while the erector spinæ have more work to do, a task that these strong muscles can easily cope with.

In side bendings the spine is most mobile in the dorso-lumbar region, just as in trunk twisting, and from here the mobility decreases both upwards and downwards (as seen in Fig. 124). It is easy enough to make the lumbar spine bend fully in a side bending. It is more difficult to make the dorsal spine do it. The position of the articular surfaces of the processes shows that in the joints there is no hindrance, but the thin intervertebral discs and the ribs hamper the movement considerably. In daily life the movement that might have taken place in the dorsal region is often transferred to the dorso-lumbar junction ; here the upper lumbar vertebræ are very mobile and so are the lower dorsal ones because of the floating ribs. If care is not taken a gymnastic side bending will be performed similarly in this region. In the localising starting positions, such as kneel sitting, cross sitting, and ride sitting, a large bending in the loin is made impossible because it would take the trunk so far over to one side that the body would topple over ; the supporting area is narrow and the pelvis cannot be displaced sideways in this position. Circumstances therefore force one to bend very little in the loin and to transfer the main bending to the dorsal region. In side bendings of this kind one must contract the muscles of the side to which one bends, but this demands practice, understanding, and willingness on the part of the pupils ; accordingly, side bendings in these starting positions are neither effective nor suitable to children and beginners. Such pupils will more easily add a dorsal side bending if they use starting positions allowing a full bending of the whole spine, dorsal as well as lumbar, and requiring less forethought and understanding when they endeavour to carry the movements to the extreme limits. The best starting position of that kind is undoubtedly stride standing position.

The dorsal region of the spinal column is the one most difficult to influence; increasing stiffness of this region will give rise to deformities, especially round back and lateral curvature. Consequently during side bending, great stress should be laid on bending the dorsal spine from side to side. Much is gained by that: The chest will be more mobile, which is good for breathing; round back and lateral curvature of the back will be counteracted; the spinal column will be able to adapt itself better to different kinds of work, and this means freedom and ease of movement as, for example, in walking, during which the sideways rocking of the pelvis causes that wave-like movement up through the spine which characterises light, free and springy walking.

13. **Close Standing (Bend Close Standing), Trunk Bending Sideways.** *Feet—close!* (*Feet close and arms—bend!*) *Trunk to the left—bend!* While the trunk is stretched up it is bent slowly, as far to the left as possible, in the vertical plane of the shoulders. During this movement the pelvis must be moved somewhat over to the right. The whole trunk must form an even curve; this is the case if the upper side is well stretched. As the neck must not take part in the movement, the head is held in the same relation to the trunk as in the erect position; both knees are fully stretched, the feet firmly on the ground. The breathing must be free.

Upward—stretch! Feet—open! (*Feet open and arms downward—stretch!*)

If the hands are in the relative erect position they are made to slide up and down the sides during the bendings. One can measure the degree of one's side bending for the sake of comparison by noticing how far the tips of the fingers are able to slide down along the leg.—In case the backbone is not equally flexible to both sides, which means the beginning of a scoliosis, one will reach less far down with the hand on the one side than with the hand on the other. During such tests one must take care to bend straight to the side. As soon as a twisting takes place a forward or backward bending is added, and the greater the twisting the further down one is able to reach.

Wing position is not particularly good as a starting position here or in other side bendings. The arm is like a prop from hip to shoulder. Accordingly it checks a bending in the dorsal region and it helps to support the upper part of the trunk, which means less work to the abdominal muscles and the erector spinæ of the upper side.

The exercise should be taken rhythmically and with little pulling movements in the extreme side bend positions (compare pp. 12-13). The pulling makes the exercise more effective as regards muscular strength and suppleness. One must bend over so far that also the dorsal spine is forced into the greatest possible flexion; and this dorsal side flexion seems more easily obtained in standing than in stride standing position.

In standing position the thigh bones are inclined outwardly from the knees. In a side bending to the left the pelvis is

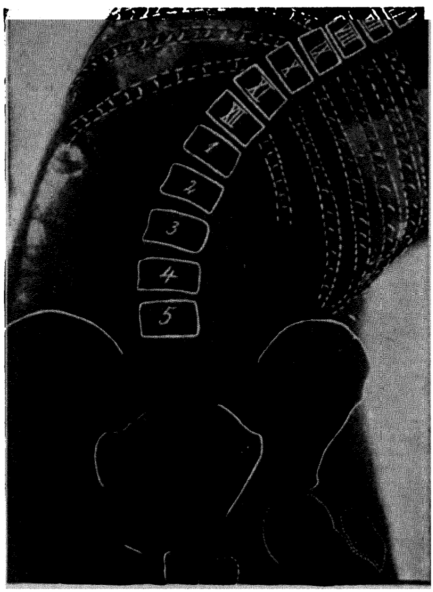


FIG. 124.—Trunk bending sideways with the feet kept together.

moved a little to the right; the left femur will now be placed almost vertical, and the right one will be inclined still more outward. By this the left hip is raised and the right lowered, but only negligibly; the pelvis almost keeps its horizontal position (Figs. 124 and 127); not so in a side bending in the stride position (pp. 256 and following, Fig. 128).

As shown in Fig. 124 the greatest flexion is found in the region between the 10th dorsal and the 4th lumbar vertebra; the spinal discs are compressed on the one side and expanded on the other. Naturally the vertebral bodies have the greater weight to carry on the side where the discs are compressed. If the spine is kept in a flexed position sufficiently long, as it is when a scoliosis is developing, the pressure will cause diminished supply of nourishment to that side of the vertebral bodies (pressure atrophy) and they will gradually be wedge-shaped. When this change has taken place scoliosis cannot be corrected.

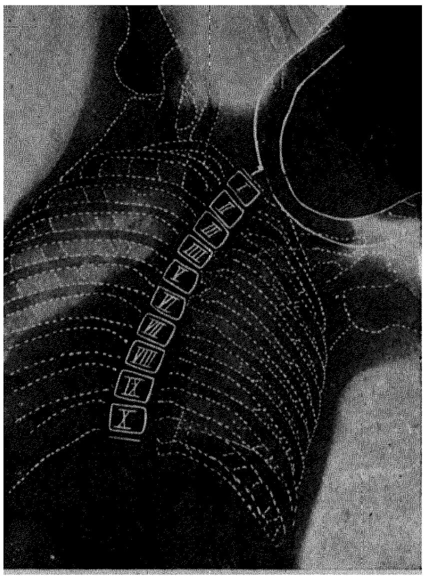


FIG. 125.—Side bending in the dorsal spine.

As seen in Fig. 124, and especially in Fig. 125, the ribs are brought nearer together on the one side and spread apart on the other; accordingly one lung will be a little compressed, the other expanded.

Common Faults. (*a*) In bending to the left the right heel is raised or the left knee is bent.

(*b*) The bending is taken too much in the loin only (by a slackening) and not in the whole spine.

(*c*) The loin is hollowed because of an involuntary twisting (compare pp. 250 and following).

(*d*) The trunk is twisted so that the chest is turned somewhat downward or upward; the exercise is then a combination of a trunk bending sideways and a trunk bending forward or backward.

(*e*) The head is bent or turned to the one side or the other.

Muscle Work (Fig. 126). In ordinary trunk bending sideways to the left the body at first is put out of balance by a slight pull on the upper part of the trunk by the muscles of the left

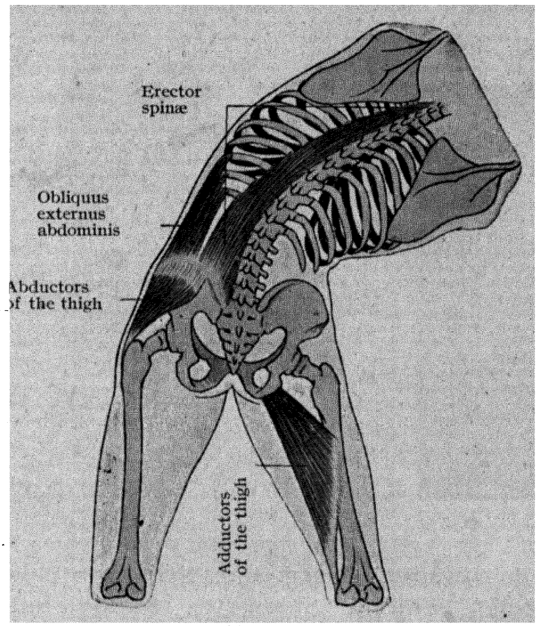


FIG. 126.

side; after this, gravity will continue the movement, and the muscles of the right side must now be put to work excentrically, as they yield evenly, and by that lower the trunk over to the opposite side. All the muscles from the mid-line of the body in front (the linea alba) to the mid-line behind (the line of the spinous processes) can here come to work—that is, the *rectus abdominis, obliquus abdominis externus and internus, and erector spinæ*. (Towards the end of the bending, when gravity cannot stretch the muscles of the upper side any more, the muscles of the under side can work to increase the bending). When the trunk is to be raised again the muscles given above work, but now concentrically.

By the displacement of the pelvis to the left in a side bending to the right an abduction takes place in the right hip-joint. This is regulated by the adductors working excentrically. An adduction in the left hip-joint is regulated by an excentric contraction of the abductors (Fig. 126).

14. **Half Stretch (Close) Standing, Trunk Bending Sideways.** *Arms—bend! (Feet—close!) Right arm upward, left arm downward—stretch! Trunk to the left—bend! Upward—stretch! Arm changing*—1—2, or (*In time*) *Arms—change! Trunk to the right—bend! Upward—stretch! Arms—bend! (Feet open and) arms downward—stretch!* The bending is only taken to the left when the right arm is stretched up (Fig. 127).

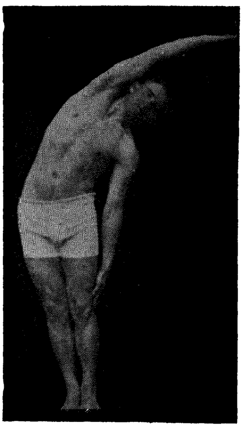


Fig. 127.

The exercise may be done rhythmically either by swinging the trunk from side to side or by pulling 2 or 3 times in the side arch position. In both cases the arms are changed by moving them in time to the bending and without stopping in bend position. The raised arm is bent slightly in over the head. For this latter form of the exercise stride standing starting position also may be used.

Common Faults. As under No. 13.

15. **Stride Standing (Yard, Ear, Stretch Stride Standing), Trunk Bending Sideways (Stride Side Arch Standing Position).** In many respects stride standing is the best starting position for all standing trunk bendings sideways. It makes vigorous muscular work and a large range of movement possible, which also means that the momentum of the body will contribute greatly to the production of suppleness. The parts of the body set in motion, head, arms, trunk, weigh a fair amount, and because of the steady base one can swing the body vigorously from side to side without losing the balance. To this may be added that stride position allows of far larger movements than the standing position. In a bending to the left the pelvis is moved so far to the right that the left leg will be inclined more than the right. Because of that the pelvis

tilts to the left, which may be seen in **Fig. 128.** The spine arises from the pelvis at a right angle, accordingly it will tilt over as much as the pelvis, and already by this tilting the trunk is moved a fair distance to the side. When the bending is now added the body will be moved much further down than in a bending carried out from the standing position (Figs. 129, b and 130; compare with Figs. 127 and 129, a). The lever on which the weight of the body acts increases and the muscles acting must work harder.

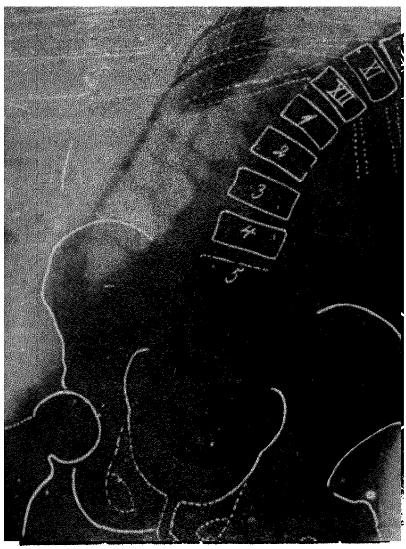
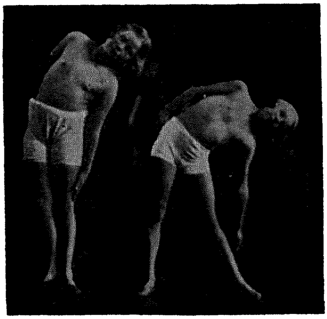


FIG. 128.—Stride standing, trunk bending sideways.

Otherwise the exercise is performed as No. 13. The firm starting position makes the rhythmical method of work particularly suitable. By that the effect, both as regards muscular strength and suppleness, will be increased. Also, here it is recommended to stop now and then in the extreme position in order to control it, and in order to make the muscles of the lower side contract strongly and bend the dorsal spine, too. Pulling movements in this position are a useful addition. They may be taken in time to 3 or 4 counts to the one side before the body swings over to the other, where they are repeated. If the arms to start with are in the relative erect position, the arm of the upper side may be swung sideways-upward and, with a slight bending, in above the head where the swinging of the arm will augment the pulling movements.



a FIG. 129. b

Common Faults. As under No. 13. In addition: (*a*) In yard position the arms are moved in the shoulder-joints.

(*b*) In ear position the elbows are moved forward.

(*c*) In stretch position, the arms and the head fall forward, or the lower arm sinks downward, the upper one is bent inward above the head.

(*d*) In rhythmical bendings, the body is not swung upward through the starting position, but carried somewhat forward.

16. Ear Side Lunge Standing, Trunk Bending Sideways. In side lunge standing position, with the hands in ear position or placed on the crown of the head (high ear), trunk bending sideways is taken towards the stretched leg. It may be done rhythmically a number of times to the one side. The trunk is moved up and down in a number of fairly quick swinging movements while the right knee gives or the foot pushes off the floor alternately with the knee bending so as to increase the swinging. The deeper the knee bending the more vigorous the exercise becomes.—The change from side to side is taken through the erect position, or the feet may be kept in their places, and lunge position to the opposite side is simply taken by stretching the one knee and bending the other.

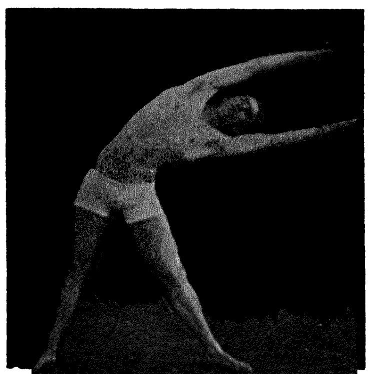


FIG. 130.

The exercise may also be taken with rhythmical bendings from side to side. The change between the two lunge positions is then done without moving the feet. The rhythm not too quick, as it must allow the body to move through the erect position in a big swing.

Now and then a halt is called in the side arch position for the sake of control. If now the left arm in a bending to the left is carried to yard position, either parallel with the leg or with the fingers touching the leg, a fine and plastic position is obtained (Fig. 131).

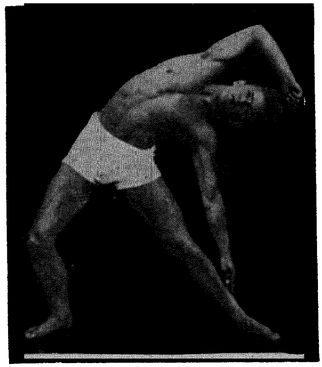


FIG. 131.

17, **Wing Side-Toward Fixed Standing, Trunk Bending Sideways.** Wall bars. *Right side toward and a long step from, to the wall bars—run! Right foot between the third and fourth* (*fourth and fifth*, and so on) *bar—fix!* The right foot is raised sideways, the toes put between two bars and turned straight upward, so that they form a hook and hold fast in the bars; the knees stretched, the left leg vertical or a little oblique (with the foot farther from the bars than the hip); shoulders, hips, and legs in the same vertical plane, which is at right angles to the wall bars.

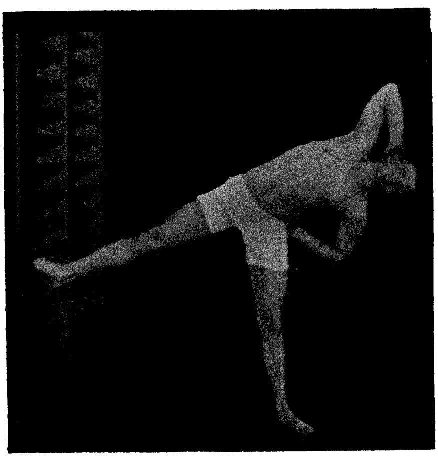


FIG. 132.

Hips—firm! Trunk to the left—bend! The exercise is done as an ordinary trunk bending sideways; the trunk is bent so far over that the fixed foot must hold very firmly to prevent the body from falling (Fig. 132).

Upward—stretch! Trunk to the right—bend! The trunk is bent as far as possible towards the bars. It is only a small bending which can be done here, but the side away from the bars is very strongly stretched (see Fig. 133). In this position pulling movements with the trunk should be taken (compare pp. 12–13).

Upward—stretch! Foot—down! About—turn! After some practice the change is performed by one word of command: *About—turn!* The exercise is then done in the corresponding way with the left foot fixed in the wall bars.

Hands—down! or *Stand—erect!*

By fixing the foot in the wall bars the pelvis is tilted, the more the higher the foot is placed; very supple individuals can fix the foot at hip level so that the leg is almost horizontal. As the body is kept erect in the starting position there is in reality a side bending towards the wall bars at the outset. The oblique position of the pelvis, here as in side bending from the stride standing position (p. 256), enables the trunk to move far over to the side in a side bending away from the wall bars, even so far that the shoulders almost reach hip level. A further tilting of the pelvis during the side bending contributes towards this as there is an additional abduction in the hip of the supporting leg, and an adduction in the other (compare positions of pelvis in Figs. 132 and 133). Because of the large movement, the bending away from the wall bars will, first and foremost, develop strength. The bending towards the bars produces suppleness. The dorsal spine will bend more in this than in almost any other side bending. Beginners may have difficulty in keeping balance with the foot fixed in the bars and this will handicap the work to a certain degree. But as soon as the balance difficulty has been overcome, the position is an excellent starting position for a side bending; the bending may then be taken rhythmically to and from the bars (Fig. 134).

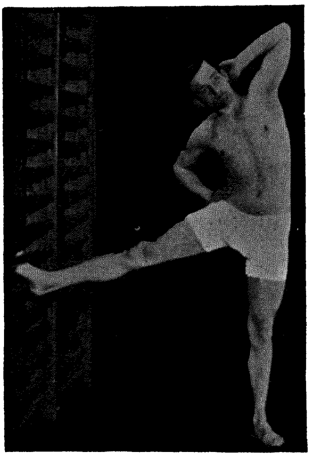


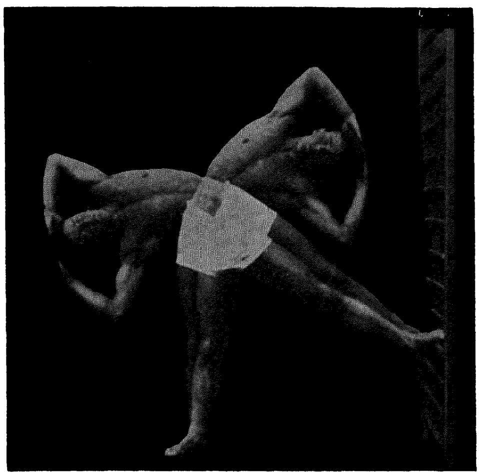
Fig. 133.

Common Faults. (*a*) The leg fixed in the bars is held obliquely forward, the foot is not turned upward enough, and therefore cannot hold fast.

(*b*) The trunk is bent forward or turned in the bending.

C. Trunk Fallings (or Leanings) Sideways

18. **Wing Thigh-Support Standing, Trunk Falling Sideways with Leg Raising Sideways.** Beam somewhat under hip height. *Left side against, to the beam—run! Hips—firm! Stand—close!* The left thigh is supported against the beam so closely that the leg is vertical, *i.e.* the foot a little under the beam.



a FIG. 134.[1] b

With leg raising sideways, trunk to the left—fall! (or lean). By a leaning sideways in the left hip-joint the body and leg, held exactly in continuation of one another, are moved slowly to horizontal position at right angle to the beam (Fig. 135).

Upward—raise! A step to the right—march! Right about—turn! Stand—close! and so on. *One step to the left, hands—down!*

Common Faults. (*a*) The leg is raised too late in the trunk falling sideways and lowered too early in the trunk raising.

[1] The film has been exposed twice, in positions a and b.

(*b*) The leg is not raised high enough.

(*c*) The leg is moved forward or backward too much, which causes the trunk to lie obliquely or to be turned a little forward over the beam.

Muscle Work and Importance of the Exercise. In trunk bendings sideways and in trunk twistings the various joints of the spine are moved as much as possible, but in trunk fallings or leanings sideways the spine is kept practically immobile. The supporting hip-joint is the only joint that is moved fully and that only as regards movement sideways, abduction. The abdominal and dorsal muscles work statically. Setting aside the hip-joints, the only effect of the exercise is the development of muscular strength. The pupils are trained in endurance as regards the keeping of positions, and this is of value in daily

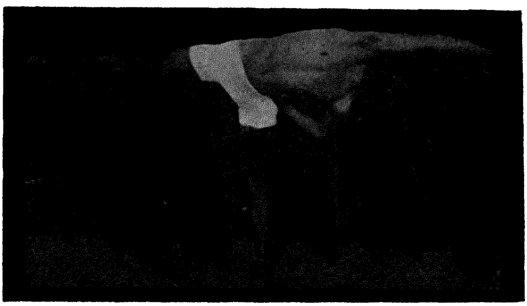


FIG. 135.

life where we often have to keep certain positions for a long time. Exercises with static muscle work form the branch of gymnastics known as "static gymnastics," which ought not to be neglected in favour of "dynamic gymnastics" (gymnastics of movement).

In a trunk falling sideways (Fig. 136) gravity will cause an abduction in the supporting hip. The adductors (*pectineus, adductor brevis, adductor longus, adductor magnus*, and *gracilis*) are called into action. Working eccentrically, they lower the body into position and by concentric action they raise it again. Gravity will bend the back, but this is prevented by static work of the *abdominal muscles* and the *erector spinæ* of the upper side. The raised leg is kept up by the abductors (*gluteus medius* and *minimus*, *tensor vaginæ femoris*). This leg is in the relative erect position so the muscles here are also working statically.

The exercise may be performed differently. Instead of thigh-support, the lower hand may take support on a stool, a form, or a low beam, etc. The pupils stand in the erect position a short step from the apparatus. *Quick trunk falling sideways* — **1—2.** On 1 the body leans quickly to the side, the lower hand is placed on the apparatus, the upper arm is swung sideways-upward to stretch position, and the free leg is raised. If one is supple enough to lean further over than the supporting arm allows, the arm must be bent. On 2 the erect position is resumed quickly.

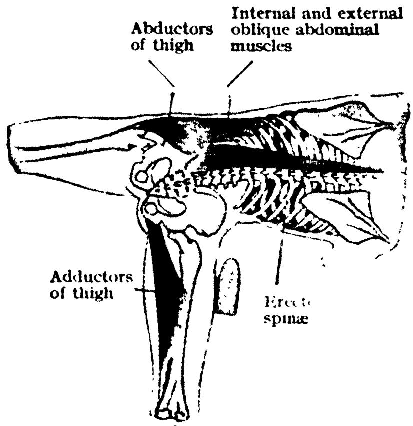


FIG. 136.

In this form of the exercise the balance difficulty is greater than in the former, but the exercise does not affect the muscles so much as part of the weight of the body is carried by the supporting arm. The exercise is readily taken with children (stools and forms are often brought out for other exercises and could be used then for this, too). It is to a certain extent an introduction to cartwheeling.

19. Grasp Trunk Falling Sideways with Leg Raising Sideways. Wall bars. *Left side towards, a long step from the bars, to the wall bars — run! Arms upward — stretch! With leg raising sideways and grasping the wall bars, to the left — lean!* By a leaning sideways in the left hip-joint the body is moved slowly towards the bars and almost into horizontal position.

At the same time the left leg, fully stretched, is raised sideways as high as possible. When the left hand reaches the bars it is moved down quickly and grasps a bar at about knee level; right hand grasps the bar it touches, or the one below, vertically above the left hand. There must be room for the head; the arms should be stretched, the lower arm pushes the body away from the bars, whereas the upper one pulls upward; the supporting leg straight; arms, shoulders, hips, and legs in the same plane at right angles to the wall bars (Fig. 137).

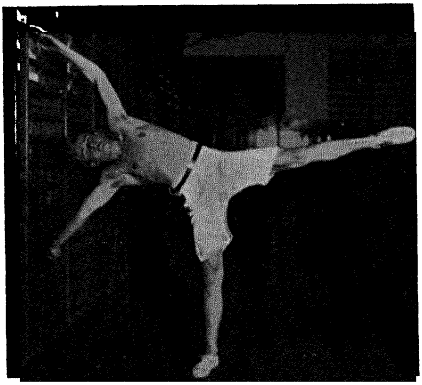


FIG. 137.

When the side falling has been learned a leg lowering may be done on the command, *Leg lowering*—1—2. On 1 the upper leg is lowered slowly as much as possible; on 2 it is raised again.

Later it may be taken quickly as a leg swinging downward-outward. When the leg swings out it may lift the body with it while the lower arm pushes strongly and the upper one pulls; the lower leg swings out to the upper leg and the foot is again placed quickly on the floor when the trunk is lowered, whereas the upper leg is kept raised sideways.

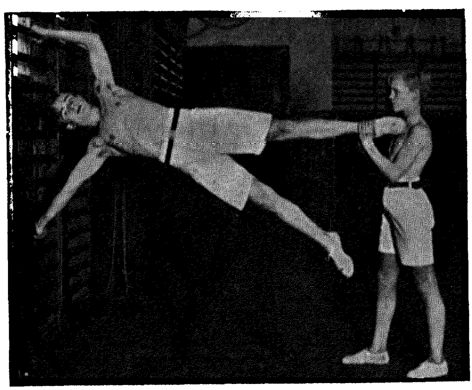


FIG. 138.

In side falling position, No. "twos" may support the raised legs of No. "ones," and these latter can now practise a raising of the lower leg (Fig. 138).

Common Faults. (*a*) Hands not vertically above one another.

(*b*) Hands grasping too high so that the body is not leaning far enough over.

(*c*) Upper leg not raised high enough.

(*d*) During the leg lowering the trunk is turned facing the bars.

(*e*) When the trunk and the lower leg are lowered after a leg swinging sideways the upper leg is also lowered.

20. **Side Holding.** Wall bars. Taken as the previously described side falling leg swinging downward-outward, but the body is held a moment in the horizontal position, legs straight and together. It is best introduced by the pupils working freely without any command. The exercise is easier if the knees are drawn up towards the chest in the horizontal position. It may also be introduced by swinging the legs up till the feet touch the top of the wall bars ; then the body is slowly lowered through the horizontal.

Well-trained gymnasts may perform the exercise high up in the wall bars. In that case the feet push off from a bar to which they are again lowered.

Muscle work as in grasp side falling (pp. 268 and following).

D. Side Fallings (or Side Hand Lyings)

21. **High Side Falling (High Side Falling Position).** Beam, wall bars, balance bench, etc. Apparatus first at knee height, later lower.

Facing the beam (wall bars, etc.) half a step from—run ! Side falling to the left 1—2—3. On 1 the first movement of high front hand lying (see p. 294) is taken ; on 2 the second movement ; on 3 the body is turned so that the left side is turned downward ; the body is borne by the stretched left arm, which as far as possible should be at right angles to the body, and by the outer edge of the left foot ; the body is kept quite straight, as in the erect position ; the right hand is placed on the hip, and the right foot is kept over the left in the close position. The greater distance between hand and foot, the greater muscle action.

Changing to the other side—1—2. On 1 the body is turned towards the apparatus, the right hand is put on it, and the high prone falling position is taken ; on 2 the body is turned to side falling on the right arm.

From position—1—2—3. On 1 high front hand lying position is taken; on 2 and 3 the erect position.

If beginners have difficulty in keeping balance they may steady themselves by putting both feet on the floor, one in front of the other.

Common Faults. (*a*) The hips are lowered, so that the body hangs down in a curve.

(*b*) The distance between the hand on the beam and the foot is too small.

(*c*) The head is brought forward, and the pelvis backward by a bending in the hip-joints.

Muscle Work. In side falling *triceps* keeps the arm stretched. The body is inclined to glide away from the arm, which must be kept in, that is to say, it is drawn downward in the same way as in a heaving exercise, namely, by *pectoralis major* and *latissimus dorsi ; pectoralis minor* helps in keeping the shoulder-blade downward. Gravity will make the body glide down past the shoulder-blade, so that the shoulder-blade moves too far in over the back; this is prevented mainly by *serratus magnus.* Gravity will bend the loin, so that the trunk hangs down in a curve; this is prevented by the muscles of the lower side—*rectus abdominis, externus and internus obliquus abdominis, and erector spinæ.* In the lower hip-joint gravity will cause an adduction; this is prevented by the abductors, *gluteus medius and minimus.* In the upper hip-joint gravity will cause an abduction, which is overcome by the *adductors.*

22. **High Side Falling, Leg Raising.** Apparatus as in 21. *Leg raising*—1—2. On 1 the right leg is raised slowly with knee and ankle fully stretched vertically upward as high as possible. The lower part of the trunk is somewhat lifted by the lower leg pushing strongly against the floor. Both legs, hips, and shoulders are kept in the same vertical plane. On 2 the leg and body are lowered slowly.

Common Faults. As given under 21; in addition: (*a*) The leg is raised obliquely upward.

(*b*) The body is not raised.

23. **Side Falling (Side Falling Position).** *Side falling on the left*—1—2—3. On 1 and 2 the first two movements of front hand lying (p. 298) are taken; on 3 side falling position is taken on the left hand, as described in 21, with the right hand on the hip. The exercise can also be done with that arm in the stretch

position, when this must be stated in the command ; from front hand lying the arm is then moved the shortest way up to the stretch position.

Changing to the other side and the return movement is described in 21.

The exercise can later be combined with leg raising.

Side falling may be taken from long sitting or crook sitting position. *Side falling on the left*—1—2. On 1 the left hand is placed on the floor a short distance behind the body and in line with the legs. On 2 the body is raised to side falling position.

The feet will slide, particularly on a slippery floor, so the muscles from trunk to arm (the "heaving muscles") on the lower side have to work hard to prevent the body from gliding away from the arm. Children and beginners may therefore place their feet against the wall or the wall bars or against their

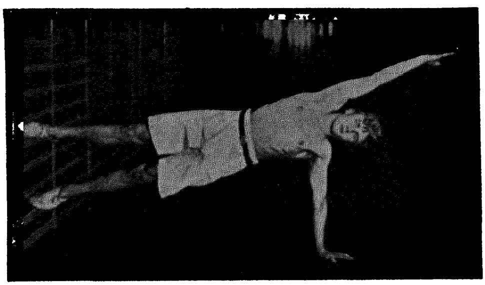


FIG. 139.

partner's feet, No. "ones" and "twos" sitting opposite one another in the long sitting starting position.

Common Faults. As under Nos. 21 and 22.

24. **Horizontal Side Falling.** Form, stool, wall bars, beam at knee level. The pupils stand 2 steps away from, and with their backs towards the apparatus. *Horizontal side falling on the left*—1—2—3. As in 23, but on 3 the inner side of the right foot is placed on the apparatus and the left foot is raised up to the apparatus ; it may be placed against it, which makes it easier to keep the balance, or it may be held just under it. Leg lowering with the lower leg may be practised in order to keep the pupils in position a short while (Fig. 139). The changing is done through front hand lying with both feet on the floor.

The exercise may also be done with living support, each No. "two" holding the foot of No. "one."

25. **High Grasp Side Falling.** Wall bars. The pupils stand a short step from and facing the wall bars. During a knee bending they grasp bar No. 5 (later 4—1) from the bottom, just opposite the middle of the body, the right hand grasps the bar which can just be reached without any stretching of the knees, the right hand vertically above the left, left thumb upward and right thumb downward (Fig. 140, b).

Side falling—1—2. On 1 the legs are thrown backward, the feet pushing off and the arms assisting, and the body turned to the side falling position with the left side downwards and at right angles to the wall bars (Fig. 140, a).

a FIG. 140. b

On 2 the feet are brought back to the starting position, as shown in Fig. 140b, pupils facing the wall bars.

The feet should be thrown to and from the position in a kind of jump and not dragged across the floor.—After some practice the exercise may be done in time with or without counting aloud. The nearer the floor the lower hand grasps the more difficult the exercise (just as in high side falling). With a suitably high grasp this exercise lends itself well to little children. Until their arms are strong enough they may put the feet out in the position one foot at a time and drag them back across the floor.—The exercise is a good introduction to side holding.

26. **Grasp Side Falling (Grasp Side Falling Position).** Wall bars, beam about chest height. *Facing, one step from, to*

the wall bars (beam)—run ! Grasp side falling on the left hand—1—2—3. On 1 and 2 the first two movements of front hand lying (see p. 298) are taken ; on 3 the body is turned to side falling on the left hand and the right hand grasps a bar (beam) vertically over the left. In the wall bars the grasp is as high as possible, leaving room for the head. The body must be carried by both arms, so that the lower arm is pushing it upward and the upper arm is dragging it upward. Otherwise as high side falling position.

If the beams are used, all can get the upper arm stretched by putting the lower arm nearer to or farther from the beam.

Changing to the other side—1—2. On 1 the right hand is put on the floor and front hand lying position is taken ; on 2 the body is turned to side falling position on the right hand and the left hand grasps the bar (beam).

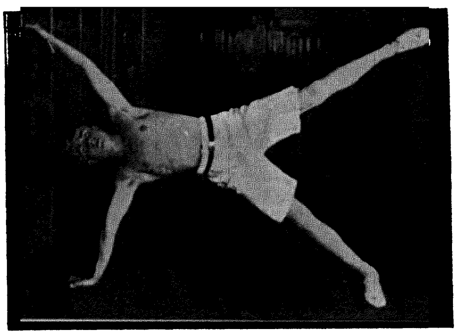


FIG. 141.—Grasp side falling, leg raising.

From position—1—2—3. On 1 the front hand lying position is taken ; on 2 and 3 the erect position.

The exercise can later on be combined with leg raising, done as described in 22 (Fig. 141).

Common Faults. As given under 21 and 22.

Muscle Work (Fig. 142). The lower arm is kept straight by *triceps* ; this arm must push the body away from the bars—that is, do a movement similar to that in yard standing, arm raising upward ; the working muscles are, therefore, *deltoideus* and those muscles which turn the shoulder-blade outward, the *serratus magnus* and *trapezius*. The upper arm must draw the body upward—that is, do a movement similar to that in a body raising (heave); the muscles working are, therefore, *biceps, pectoralis major*, and *latissimus dorsi*. In the lower hip-joint the *abductor* muscles are working, and in a leg raising these are working also in the upper hip-joint.

In grasp side falling exercises the abdominal muscles and the extensors of the back are working mainly in the movements to and from the final position; in the final position itself the latissimus dorsi of the upper side is doing most of that work

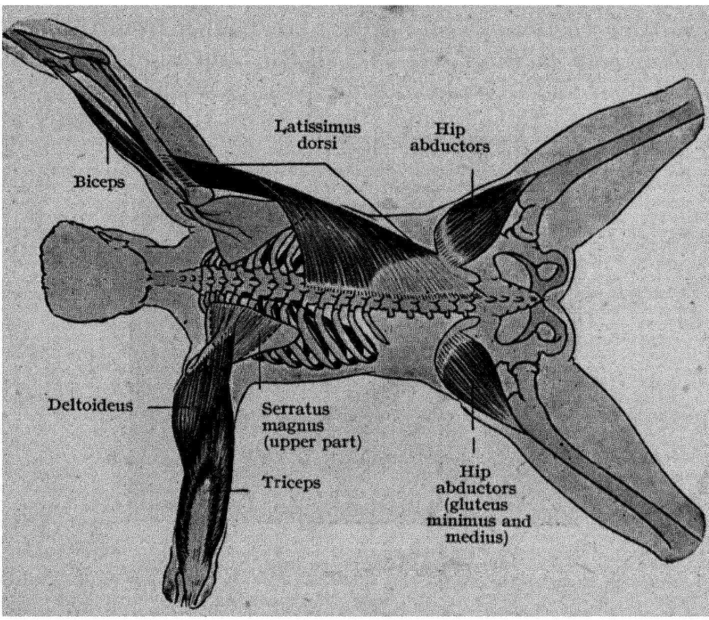


FIG. 142.

which in high side falling and ordinary side falling is done by the muscles of the lower side. It pulls upward and prevents a bending in the loin.

E. Outward Lunging as a Lateral Exercise

27. Bend Standing, Lunging Outward with Alternate Arm Stretching Upward and Downward (Half Stretch Lunge Outward Position). *Arms—bend! With alternate arm stretching upward and downward, lunging outward—1—2—*

(*right*) 3—4. On 1 lunging outward[1] to the left is taken (pp. 147 and 148), and at the same time the left arm is stretched up and the right arm down, the right hand a good hand's-breadth distance from the leg (Fig. 143, showing a lunge to the right, thus opposite the description). On 2 the foot is drawn back and the arms are bent. Finally, *Arms downward—stretch !*

The exercise can be done also by advancing in zigzag, the rear foot always being moved up to the front one. After the bend position is taken the command is : *With advance, alternate arm stretching upward and downward and lunging outward*—1—2—(*right*) 3—4, and so on.

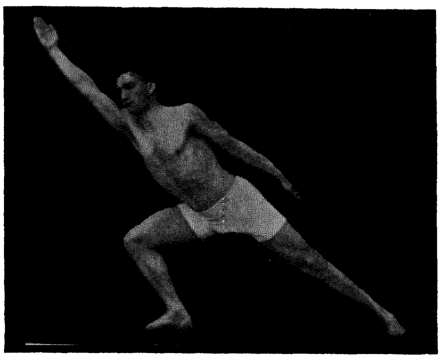


FIG. 143.

28. Ear (Stretch) Twist Lunge Outward Standing, Trunk Bending Sideways. In the ear (stretch) lunge outward standing position to the left the following command is given. *Trunk to the right—twist ! To the left—bend !* The trunk is twisted till the body and the legs are in the same plane and then bent down over the left knee, the knee being kept well flexed and moved outwards. The exercise is very tiring to the front knee.

[1] P. H. Ling demanded that outward lunging should be taken with a long step, and that the front leg from the knee downward should be parallel with the rear leg. This demand is hardly ever fulfilled nowadays, but Greek sculpture shows that the ancient Greeks did fulfil it. According to that standard, the front knee and ankle-joint are bent too little in Fig. 143. Those who fully carry out that demand will realise what a grea effort must be made both in the knee-joint and in the ankle-joint.

F. Game-like Exercises

29. "Coffee-Grinding" with Ring Grasp. Two children grasp hands (ring grasp), and turn round with an alternate raising of the arms (Fig. 144). The first few times the children should be told to lift one pair of arms and turn themselves in that direction before they begin to revolve, as otherwise they easily make a mistake about the side to which they are to turn. After some practice the children can stand quite close together and grasp one another's hands with the arms in yard position; in the turning the main point is to keep the arms stretched and in continuation of one another. Both forms can be done either on the spot or with travelling sideways. In the latter case the children can be arranged along the walls in 2 rows with double distance (for example, by walking round).

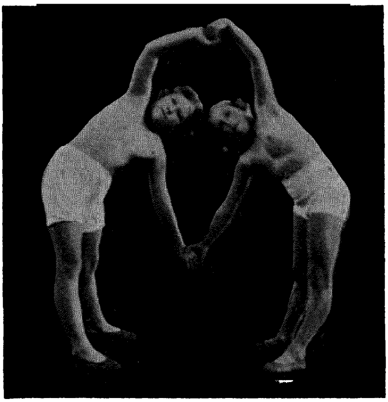


FIG. 144.

30. "Sawing Wood." (*a*) *In cross sitting position.* Two children sit opposite each other in the cross sitting position, grasping each other's hands, and knees touching the partner's knees. The movement of sawing is imitated by alternate stretching and bending of the arms (reach and across bend position) while the trunk is twisted as much as possible. The exercise is first taken by numbers so that the teacher can see whether the twisting is carried out fully and the bent arm lifted to the across bend position. Later it is taken in time to a song or to the imitation of the sound of sawing (s s s!) (Fig. 145). The sawing may be heavy as in "wet wood,"

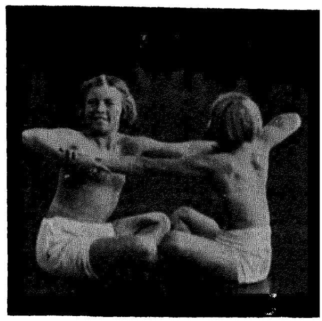


FIG. 145.

i.e., the one will resist the other during the twisting, or the saw may "get stuck," *i.e.*, the one will try to hold the twist position against the pull of the other. In these cases the exercise is taken freely, not in time. The muscles producing the twisting are now made to work harder than is usually the case in trunk twistings (pp. 241 and 250).

(*b*) *In stride standing position.* The children stand in stride position opposite each other and a short step apart. The grasping, the positions of the arms, and all forms of the movements repeat themselves as under (*a*).

31. **Cross Sitting, Trunk Twisting.** (The tailor sewing). In cross sitting position each child puts its right hand on its left knee, back straight. The left arm is now moved sideways-upwards and the body fully twisted as they "take a stitch and pull the long thread through." The head is turned and the eyes follow the hand. The movement finishes with a little jerk as when the thread is pulled tightly to. Children enjoy the exercise, and they may take it in time as they sing out, "*Stitch and pull!*"

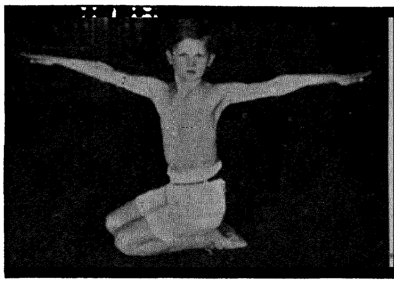


FIG. 146.

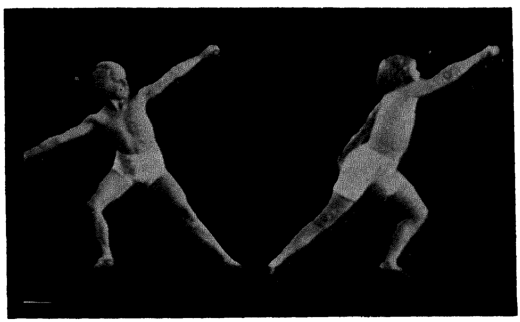
32. **Half Yard, Half Wing (Yard) Kneel Sitting, Trunk Twisting.** (The weather cock). The children swing the body in little twists to the left, imitating a vane, left arm in yard and right arm in wing position. Then the movement is repeated to the right with the arms changed. When both arms are in yard position the weather cock swings from side to side, "it turns easily but it keeps straight and stiff" (Fig. 146).

33. **Bend Stride Standing, Arm Punching with Quick Trunk Twisting.** (Boxing.) As the left arm punches forward the trunk is twisted quickly to the right, the head remaining turned forward. Then the right arm punches forward and the whole position is reversed. The punching may be directed straight forward or somewhat to the right or left, according to the supposed movements of the imaginary opponent. The more oblique the punching the greater the twisting of the trunk.

34. **Throwing.** (*a*) *Walk standing, throwing.* Each child stands with the left foot a long step behind the right; right

arm held horizontally forward aiming at the supposed target. Left hand, lightly closed as if gripping a ball, carried forward near the right hand. The movement of throwing is performed to two counts. On 1 the body twists well to the left, left hand is swung quickly downwards-backwards and is then held about head level. On 2 the trunk is twisted quickly and the hand is swung vigorously forward as if throwing a ball in the direction in which the right hand is pointing. First practised by numbers and then in time while the children count loudly, 1—2, or *swing !—throw !*

The children may form up in two lines facing each other, and play at snowballing. They stoop down, gather some snow, press it together, and throw. The exercise may be taken in time, the children saying, *Gather !—press !—throw !* or it can be taken freely.



a FIG. 147. b

(*b*) *Oblique Lunge Standing Throwing.* Each child stands with the left foot a long step behind the right. The trunk twists and leans backward as the rear knee is bent and both arms carried to yard position, arms held obliquely because of the leaning of the body. (Fig. 147 shows the position with the right foot to the rear.)

From this position the movement of throwing is performed. Left arm is bent and thrust forward-upward, passing close by the head, the trunk is twisted and carried forward over the front foot while the knee is bent and the rear leg stretched. During this movement the right arm is carried downward-backward till it is in line with the left arm (Fig. 147, b). The exercise is, at first, and for some time, performed slowly so that the children may master the various complicated movements and make the movements glide smoothly the one into the other in the right order. Afterwards it is taken quickly.

Together with this rather graceful exercise actual ball-throwing should be practised. No. "ones" stand in a line facing a wall, each with two tennis balls. They throw the balls, one at a time, hard against the wall, and No. "twos" pick up the balls so that their partners may have many tries without wasting time by changing position. Both hands are equally exercised.[1]

35. **Bend Kneel Sitting, Trunk Bending Sideways.** (Pulling the cork.) In the bend kneel sitting position rhythmical side bendings from side to side are taken, the bendings being gradually larger and larger up to a certain number, for example, 10. On 10 the children raise themselves quickly to kneeling position and stretch their arms up above their heads, imitating the sound produced when a cork is pulled.

The exercise may be done similarly in the bend close standing position.

36. **Standing (Close, Stride, Yard Stride Standing), Trunk Bending Sideways with a Slap against the Legs.** The trunk bending may be taken from side to side in 3 degrees, each bending deeper than the other. During the first bending the slap falls by the knees, then on the legs a little below the knees, and thirdly, as far down on the legs as possible. In standing and close standing position the children cannot reach so far down as in stride standing position. When yard position is used each arm should be moved quickly to the yard position after the slapping. By taking the exercise as described, more energy may be put into the third movement than if all bendings were equally large. It is advisable to call a halt now and then in the side arch position in order to correct it.

37. **Side Lunge Standing, Single Hand Wrestling in Pairs.** The children stand in two lines, and turn the left side

[1] Throwing is a powerful exercise, not only for the arms and legs, but also for the trunk. Only a vigorous trunk twisting will put force into the throwing. The ancient Greeks valued throwing as an exercise for bodily development. Two of the items in their contest consisting of five exercises, pentathlon, were throwing exercises, namely, throwing the disc and throwing the javelin. In disc throwing a strong and effective twisting is involved. Right foot is placed forward to fix the pelvis, while the right arm swings the heavy disc backwards and twists the body till it is tense like a tightened spring; in the next moment it is released, and, assisted by the arms and legs, the disc is hurled away.

As throwing exercises are so powerful, they should be practised equally to both sides, especially during the years of growth.

towards each other; they give each other the left hand, best with wrist grip, put the nearest foot towards each other so that the outer edges touch, and take a long lunging sideways with

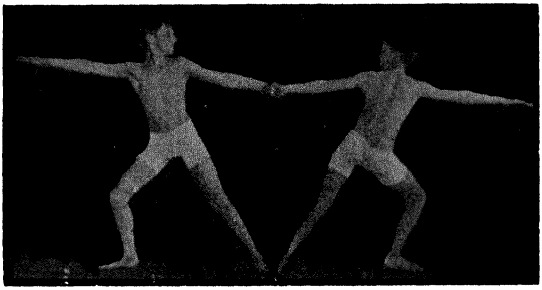


FIG. 148.

the right foot. The aim of each now is to drag his opponent over towards himself without moving his own feet. Both must keep the left leg stretched all the time (Fig. 148).

The two lines may be formed up several steps apart and lunge towards each other. When the partners meet in the middle they join hands with wrist grip and pull, trying to tug one another to the wall.

38. **Hook Pulling.** The children stand in two lines in the middle of the room, give one another the left arm (with arm hook grasp), and try to pull each other over to the wall.

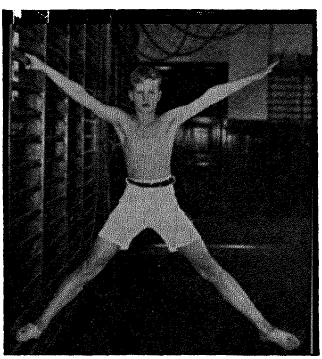


FIG. 149.

39. **Cross Position in the Wall Bars.** The children stand to begin with, on one of the lowest bars, grasp with one hand at head height. *Cross position to the left.* They stretch the arm and leg of the other side sideways, while they allow the body to fall as far away from the wall bars as possible and stretch the fixed arm. The arms are a little above shoulder level, almost in flight position, the legs wide apart, and arms and legs form a cross (Fig. 149). Gradually it is taken higher up in the wall bars. In order to keep the children in the position a little while they may play

at being firemen standing on a ladder and directing the hose against the burning house, now towards the roof and now towards the ground floor, now to the right, now to the left. On the command *Change!* the position is reversed.

The changing may also be done across the gymnasium to the wall bars opposite. They may now compete as to who gets into position first. When taken thus, with half of the class at each wall, the children should all face the same end of the hall both before and after the changing, so that alternate hands may be grasping the bars.

The exercise ends with a landing to the side.

40. **"Lunging to War."** The left foot is put outward in lunge position with a stamp, while at the same time the left arm is swung forward with a movement to imitate a sword thrust at an opponent, the rear arm raised a little away from the body. The lunging is made fairly long as the forward knee is well bent, otherwise the form is free. Changing is done in two movements. In the first the erect position is taken; in the second lunging outward to the right.—The lunging can also be taken with advancing forward. The first lunge is then taken straight forward, while the standing foot is turned out: in the advance the erect position is not taken, but the rear foot is moved past the front one in one movement, while the front foot is turned outward.

§ 20. Abdominal Exercises

Abdominal exercises mainly develop those muscles which form the front and sides of the wall of the abdomen, going from the ring formed by the lower border of the thorax to the ring of the pelvis. They lie in several layers and their fibres cross each other, so that in connection with the diaphragm they form a sort of hollow muscle which by a general contraction (in somewhat the same way as the heart, for instance) diminishes the cavity they surround (abdominal pressure).

The abdominal viscera are, so to say, heaped up and resting on one another. Those underneath are lying in the pelvis as in a bowl, which would be quite suitable to bear the whole pile of intestines, if it was complete and stood upright. But the pelvis has other tasks, requiring especial shape and position. Regarded as a bowl the pelvis lacks all the front side right down to the symphysis and besides it tilts forward just to that side, where it has its great cut or incision. The intestines, therefore,

FIG. 150.—Girl and boy with prominent abdomen.

would tumble out of the bowl if this opening was not closed by the abdominal muscles; thus only a part of the weight of the intestines rests on the pelvis; the remainder rests on the abdominal muscles.

Different individuals have different pelvic inclinations. As a consequence there must be differences in the amount of the weight supported by the abdominal muscles. The less the pelvic inclination the less strain on the muscular wall; the greater the inclination the greater strain. In individuals with hollow back the abdominal muscles have a greater weight to support when holding the viscera in place than in those with a normal back.

As the abdominal cavity may be looked upon as filled with a fluid the pressure on the abdominal muscles is considerable, and this pressure is a side pressure which makes the work of the abdominal muscles still greater keeping the viscera in their right position.

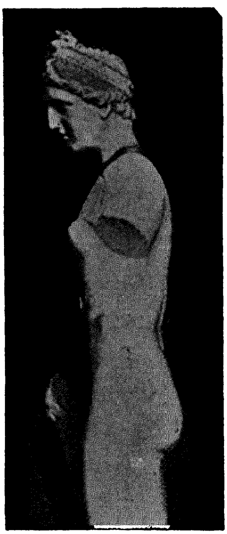


FIG. 151.[1]

FIG. 152.[2]

[1] Fig. 151 is one of the figures in a group of the Three Graces (Charites) from Siena in Italy.

[2] Fig. 152, called Venus Anadyomene, was found in North Africa during the Great War. Now in the Terme Museum in Rome. One of the finest female figures of Greek art.

One will understand that a prominent abdomen (Fig. 150) is generally found in individuals with hollow back—so much the more as hollow loin is mostly caused by slack and badly developed abdominal muscles, together with a poor development of the other muscles as well (as a contrast to this, see Figs. 151 and 152).

In a normal carriage it is almost exclusively the extensors of the back that carry the trunk, the abdominal viscera are not

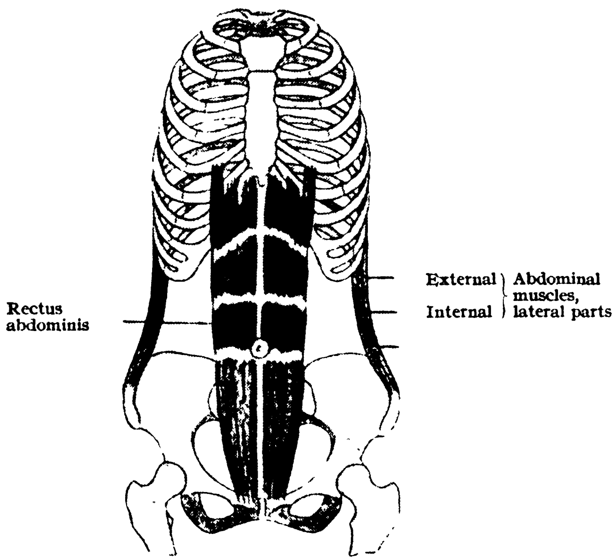


FIG. 153.—Rectus abdominis. The "white line," the median line of the abdomen, is seen between the muscles.—The vertical lateral parts of the external and internal oblique muscles (Figs. 155 and 156) are acting in balancing the back in the erect position, consequently they form part of the muscles employed in maintaining the erect position.

subjected to any pressure from above. But if these extensors give way, either owing to bad habitual carriage or to muscular weakness, the upper trunk sinks down over the abdomen and the cavity will be short and wide (as in long round back, p. 110). The extensors of the back are not carrying the whole weight now, but a part of it is supported by the viscera. This will naturally increase the pressure on the abdominal muscles.

If the abdominal muscles are weak, a common condition, especially in women, the abdominal wall gives and the abdominal organs may be allowed to sag out of place (sagging stomach, floating kidneys, etc.), and by that several common forms of indigestion are brought about. There is consequently every reason to keep the muscular wall of the abdominal cavity strong and in good, elastic tone throughout life and to counteract any tendency to hollow back.

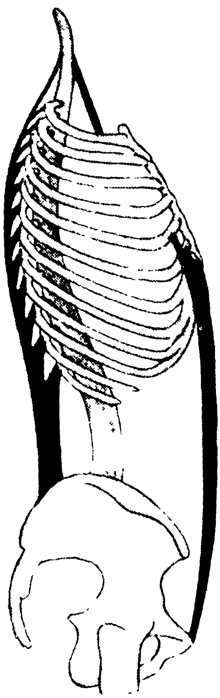


FIG. 154.—The erector spinæ from pelvis to neck on the one side and on the other rectus abdominis and the scaleni balance the trunk in the upright position. They therefore all form part of the muscles employed in maintaining the erect position.

In abdominal and lateral exercises the abdominal muscles exert a pressure on the digestive organs, and as these are easily moved they are squeezed somewhat from one side to the other in the different movements, which acts on them as beneficial auto-massage, and urges them on to stronger activity. The varying pressure thus made on the abdomen quickens the circulation through the digestive organs and the large glands in connection with them, and this is the more important because here the blood has a great resistance to overcome (by reason of the double set of capillaries) in the portal circulatory system.

The normal development of the abdominal muscles is also of great importance for the carriage (Figs. 153 and 154). If they are too short, as they often are in people doing physical work, who stand bent over their work, they help to cause and fix round back, as they prevent the chest being lifted, and thus keep the back rounded both in the dorsal and lumbar parts. If the abdominal muscles, on the other hand, are too long and slack, hollow loin will result, as the abdominal muscles do not resist when the weight of the top part of the body increases the inclination of the pelvis. Figs. 151 and 152 show ideal female figures with the right relationship between abdominal and dorsal muscles according to the contours of the body. At any rate, there is neither protruding abdomen nor hollow back. Some abdominal exercises are especially fitted for lengthening shortened abdominal muscles—*e.g.*, trunk bending backward—and others for shortening lengthened ones—*e.g.*, back lying, leg raising; and especially hanging (high) knee raising and forward-

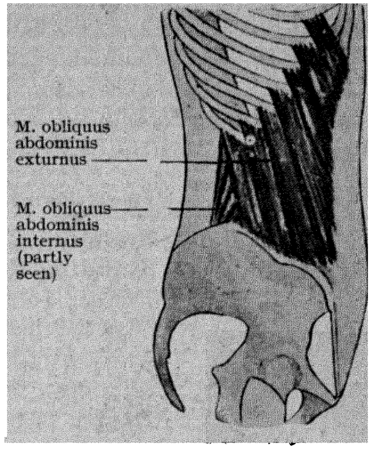


FIG. 155.

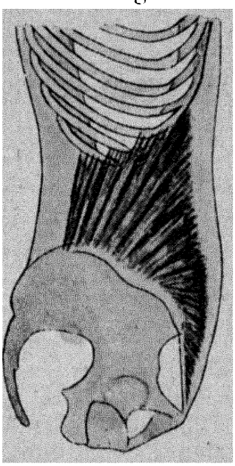


FIG. 156.

upward circling so that by using suitable abdominal exercises we may help to correct both "round" and "hollow" back.

Also, by straightening both the dorsal and lumbar curves beyond their normal position—*e.g.*, by trunk bending backward and the leg raisings given above—abdominal exercises help to give good carriage (refer to p. 126 and following).

Special attention must be paid to breathing in the performance of abdominal exercises. When the abdominal muscles are put to work the breathing will be restricted, by reason of the downward pull of these

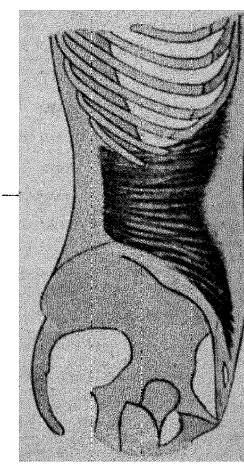


FIG. 157.

muscles on the ribs; this can be observed by the pupils becoming red in the face. As the breathing is the more restricted the harder the abdominal exercise is, the teacher must be careful not to choose exercises which lie too near the limits of the pupils' strength, and, especially in these exercises, he must remind them to breathe as freely as possible.

A. Trunk Bending Backward

1. Wing (Ear) Standing, Trunk Bending Backward [Wing (Ear) Arch Standing Position]. *Hips—firm! Trunk backward—bend!* With a stretching of the body the head is moved somewhat backward, with the chin drawn in, as in the beginning of a head pressing backward. After this the dorsal part of the spine is stretched as much as possible, while the chest is raised. Not until after this is the loin bent. The bending, therefore, must be taken from above downward; in this way the body comes to stand in a comparatively even arch and the back is most strongly straightened just where it is most in need of it—that is, in the dorsal part (Fig. 158).

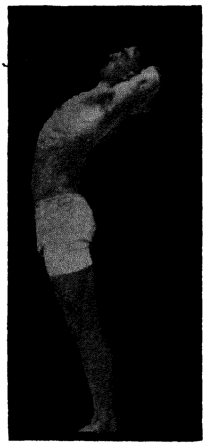


FIG. 158.

Upward—stretch!—Hands—down!

Common Faults. (*a*) The bending begins from below, and is then nearly always taken in the loin alone: often the upper part of the back is rounded in addition.
(*b*) The head is moved forward or falls too far backward.
(*c*) The knees are bent.

Muscle Work. The muscles acting first in a trunk bending backward are those that draw the head back, especially *splenius* and the *cervical parts of erector spinæ.* These muscles will tilt the head so that the chin pokes, and by bending the cervical spine backward they will increase the cervical curve. Therefore, the chin must be kept in by *longus capitis* and *rectus capitis anticus* and the neck kept stretched by *longus colli.* After that the muscles stretching the dorsal spine will act by drawing the 4 or 5 upper dorsal vertebræ backward (Figs. 159 and 160); those muscles are the dorsal extensors of the back, especially *semispinalis dorsi,* assisted by *splenius* and the cervical parts of *erector spinæ* from the upper 5 or 6 dorsal vertebræ. The ribs move with the vertebræ, partly because of the small mobility between the ribs and the vertebræ and partly because of the pull by the *scalenes*, the *sterno-cleido-mastoid*, and the *costal elevators*, the upper insertions of which are drawn backward in the trunk bending.

Only the above muscles are working during the first part of the trunk bending so *high trunk bending backward is a dorsal exercise.*

Not till the centre of gravity is moved so far back that gravity will carry it farther back by bending the loin does the

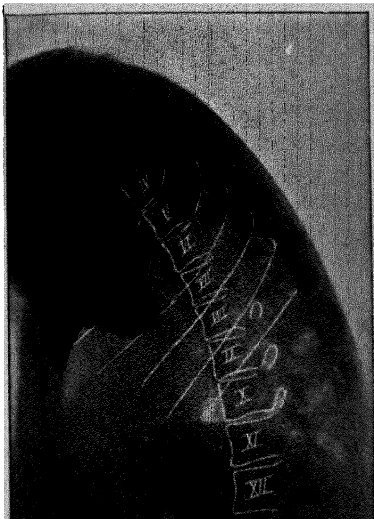


FIG. 159.[1]

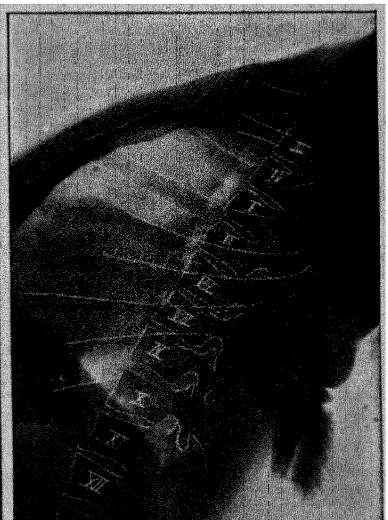


FIG. 160.[1]

exercise become an abdominal exercise. By placing a hand on the abdomen one feels distinctly when the abdominal

[1] A 23-year-old supple and well-trained gymnast sitting bent forward (Fig. 159) and bent backward over the back of a chair (Fig. 160). The dorsal spine has been stretched so much that it is slightly convex in a forward direction. The X-ray photo shows that a supple gymnast is able to reverse the dorsal curve; in other words, is able to perform a regular dorsal bending backward, not merely a stretching. But very few are as supple as that.

The pictures show how the ribs are lowered and raised during forward and backward bendings. Fig. 160 makes it clear that a trunk bending backward performed at the school desk or on an ordinary chair with a suitable back support may be very effective.

muscles begin to act and become tense. The muscles in question are *rectus abdominis,* the *external* (Fig. 155) and *internal* (Fig. 156) *oblique abdominal muscles.* By acting excentrically they lower the trunk backward. At any moment they are able to stop the movement and by concentric action to raise the trunk again. If the backward bending is allowed to go to its extreme limit it will be stopped because the abdominal muscles, the fibres of the linea alba[1] (Fig. 161), and the anterior ligament of the lumbar spine cannot be stretched any more.

The downward pull of the abdominal muscles on the ribs would round the back if the dorsal erector spinæ did not prevent it; but, as a rule, they do not prevent this rounding of the back unless they are made to straighten the dorsal spine and lift the ribs right at the beginning of the trunk bending backward. If the trunk bending begins from below with a bending backward of the loin, the abdominal muscles and the linea alba will be fully stretched by this bending; consequently they will prevent the ribs from being raised and the dorsal spine from being straightened, it may even happen that the ribs are pulled down so that the result will be not only an increased lumbar, but also an increased dorsal curve.

Beginners and pupils who have been badly taught generally perform the exercise in the manner just described. And they do it partly because it is easiest owing to the mobility of the loin, and partly because they are able to bend farther back when the loin alone is bent and the ribs lowered (Fig. 162). When the exercise begins with a stretching of the dorsal spine and a raising of the ribs the abdominal muscles and the linea alba will be partly stretched already by that, and the limit for their stretching will be reached before the lumbar spine has

FIG. 161.—Linea alba is broad from its origin on the sternum to a short distance below the umbilicus and string-shaped down to the symphysis.

[1] As the fibres forming the linea alba do not run parallel from above downward, but cross one another diagonally, the linea alba can be stretched. During pregnancy it is extended both sideways and lengthwise. Most likely it becomes less yielding with age, particularly if one never performs exercises that stretch it. It is a general law that Nature does not maintain what is not used.

bent as much as it is able. The difference is seen clearly in Figs. 158 and 162.

From this it seems clear that *a trunk bending must begin from above* and the return movement from below.

To the pull downward of the abdominal muscles on the ribs an equally strong pull upward on the pelvis corresponds. The hip-joint will therefore be stretched and the Y-shaped ligament tightened. When the hip-joints are fully stretched and the backbone bent to its limit, movement backward is only possible by a bending of the knees, and such a bending is often seen in stiff pupils.

Fig. 162.—Bending of the loin (compare Fig. 158).

When the upper part of the trunk moves backward the lower part of the body moves forward at the same time to counter balance it; and this is done by a stretching of the hips and a bending of the ankles. In the hips the trunk is held by the Y-shaped ligament; the calf muscles working excentrically act on the ankles. During the raising of the trunk the following muscles are acting on the hip-joints: *ilio-psoas*, *rectus femoris*, *pectineus*, *adductor longus* and *brevis*, *tensor vaginæ femoris*, and *sartorius*; on the ankles the *calf muscles* are acting concentrically.

The Importance of the Exercise and its Introduction. Standing trunk bending backward is an important exercise, and an exercise learned with difficulty.

It is *important* because it keeps the dorsal spine mobile, that part of the body which most easily grows stiff; and it keeps one in training as regards the correct way of stretching the back, *i.e.*, the straightening of the dorsal region (as much as is physiologically defensible) without an undue hollowing of the loin. As a matter of fact one runs no risk of straightening the dorsal spine too much; it is well guarded against any overstretching by the spinous processes directed downward, by the somewhat wedge-shaped vertebræ, by strong ligaments, and by the ribs which are strongly connected with one another.

The *difficulty* of the exercise comes from the fact that the slightly mobile dorsal spine is situated just above the very mobile lumbar spine. It is seldom that people in daily life have to perform movements which necessitate a stretching of the dorsal spine; on the other hand the occasions on which they have to bend forward are numerous. The necessary movements backward are generally performed in the lumbar region alone. As a consequence the control over the dorsal erector spinæ is gradually lost. People are able to control and work the cervical and lumbar portions of the extensors of the back as easily as, *e.g.*, the flexors of the arms, for these muscles are used daily and thereby are kept under control. It is different with the dorsal extensors, and they are hardly ever used to the limit of their contraction. The ability of innervating them at will to their utmost capacity may be lost little by little as is the case with other muscles. As time goes on, and the dorsal spine grows more and more stiff and curved, the muscular tissue of the erector muscles degenerates and is replaced by connective tissue. With this advancing degeneration the ability to move the spine lessens, all the more as the vertebræ change shape and tend to fix the round back. During the years of growth these changes may take place very rapidly, especially if the young people have heavy bodily work to do (see p. 117). When the change has once taken place the round back cannot be corrected.

But when the bony tissues have not changed shape, correction is possible. The first thing is to do away with stiffness. The ligaments and muscles in front that have become shortened must be extended. The weak and untrained dorsal muscles, unused to maximal contraction, are not able to perform this stretching Other means must be resorted to. In the gymnasium we make use of the passive span bendings, the shoulder stretchings etc. (p. 219, and following). But something can also be done at home. A bending backward over the back support of a chair, at the same time raising the arms above the head and pulling them backward in even energetic movements, is an effective and invigorating exercise which stretches the muscles in front and straightens the dorsal curve (see Fig. 160). Teachers ought to make their pupils perform a similar exercise daily over the back support of the form or the edge of the desk behind. It would counteract the bad effect of the sedentary school work throughout their school years, all of them years of growth.

At the same time as we endeavour to increase mobility by passive exercises we must work actively in order to strengthen the dorsal extensors and train them in maximal contractions, and in order to regain control of them little by little. And we must begin with exercises in which these muscles are compelled to work to the extent desired.

Such exercises may be selected from groups other than abdominal exercises; we may, for example, use exercises such as front lying, trunk bending backward on the floor; stoop standing, trunk stretching forward; head support hanging and other neck exercises described on p. 206 and following, etc.

The trunk bending itself may be practised in localising starting positions, *i.e.*, positions in which the loin is prevented from taking part in the movement: crook, cross, and kneel sitting position (Fig. 57, p. 164, and Fig. 92, p. 203). In these positions the pelvis is tilted and the inclination lessened so that the lumbar spine rises almost vertically with the curve obliterated; and it is fixed in this position as the pelvis cannot move. When a trunk bending backward has to be performed in these positions the dorsal spine *will have* to be stretched and its extensor muscles *must* work. By letting the head and the trunk sink forward as much as possible before each backward bending the muscles are made to work from their greatest lengthening during the stoop to their greatest shortening during the energetic bending backward.

For this little trunk bending backward the localising sitting positions are valuable; they are not so valuable for other exercises, and an extensive use of them is hardly justified. Even as regards trunk bending backward the use of them may be overdone, especially with children or adults who are stiff in the loin and particularly mobile in the critical region formed by the lower dorsal and the upper lumbar vertebræ. Fig. 92, p. 203, shows a boy with stiff loin.

It should also be remembered that trunk bending backward in the localising positions is only an introduction to trunk bending backward proper. When the localised muscular action in the dorsal region has been mastered without the lumbar muscles working, these starting positions have served their purpose. In these positions there is only a slight training of the dorsal extensors. The range of movement is too small and the extensors have too little work. In front lying, head support hanging, etc., they have to work much harder.

Standing ***high trunk bending backward*** prepares the way for ordinary trunk bending backward. On the command ***High up in the back, trunk backward—bend!*** the movement described above is performed. The exercise may be made particularly effective if taken at the wall bars. One stands facing the wall bars and with the whole front close up against them. The hands grasp a bar at hip level, thumb uppermost. While holding the body firmly against the bars with the arms, an energetic high trunk bending backward is taken with little pulling movements. In this firm, localising position, more force can be put into the exercise than in the free standing position. With adults who understand the exercise one can make each No. "two" put a hand against the back of the head of No. "one" and resist his movements. The exercise may also be done in kneeling position close up against the wall bars.

High trunk bending backward is not only an introductory exercise, but as a breathing exercise an exercise in itself. In connection with deep inhaling and exhaling it lends itself well to the rhythmical method of work. During deep exhaling, on which stress should be laid, head and trunk may be bent a little forward.

Stiffness is one of the characteristics of old age, and in order to combat the effects of old age one ought to counteract stiffness, especially in the spine. The one who can preserve suppleness here, the one who is able to move the 5 or 6 upper dorsal vertebræ backward as in a trunk bending backward, will preserve physical beauty as expressed in good carriage, and he will keep his chest mobile, which will be of benefit in breathing, especially during exertion.

The one who does not keep his dorsal extensors in training will lose the ability to stretch his back, stiffness will increase, and the heavy weight of head, shoulders and arms will round the back, a fact that will be seen clearly in many old people (p. 199).

It is worth while mentioning that the movement which people make involuntarily when stretching themselves after sleep is a correctly performed trunk bending backward.

High trunk bending backward, however insignificant it looks, is an important exercise. The children at school should be trained in it so thoroughly that the exercise may grow into a lifelong habit.

2. **Wing (Ear) Stride Standing, Trunk Bending Backward [Wing (Ear) Stride Arch Standing Position].** As described in 1. The stride position gives a firmer starting position.

3. **Wing (Ear) Crook Half Kneeling, Trunk Bending Backward [Wing (Ear) Arch Crook Half Kneeling Position** (Fig. 163)]. *Hands on hips (neck) place! On the left knee—down!* As the body is lowered by a bending of the right knee the left knee is put lightly on the ground a good foot-length behind and a little to the left of the right heel. The right leg and left thigh are vertical, toes of the left foot underbent; trunk straight.

Trunk backward—bend! Upward—stretch! Knee changing—1—2. On 1 the erect position is taken with the hands on the hips; on 2 the crook kneeling position on the right knee (again with hands in ear position).

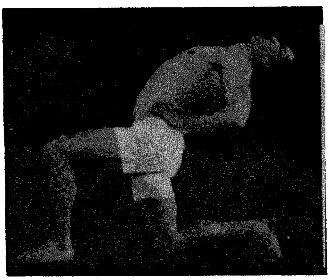


Fig. 163.

From position—up! Hands—down! or only *Stand—erect!*

Common Faults. As given in 1 (*a*) and (*b*); in addition: (*a*) The body is inclined forward in going to and returning from the half kneeling position.

(*b*) The rear knee is too near to the forward heel.

(*c*) The lower part of the trunk is pushed backward by a bending in the hip-joint of the rear leg (the pupils sit half-way back on the heels).

4. **Wing (Bend, Ear) Kneeling, Trunk Bending Backward [Wing (Bend, Ear) Arch Kneeling Position].** *Hips—firm! Kneeling*—1—2. On 1 half kneeling position is taken on the left knee, on 2 the right knee is placed on the floor a foot-length to the side of the left. The heels are together, toes underbent or ankles stretched, thighs vertical, body straight.—One can also get into the position through a deep knee bending.

Trunk backward—bend! With the hips held forward over the knees the trunk is bent backward as described in 1.

Upward—stretch! From position (or *On the feet*)—1—2. On 1 the left foot is brought quickly past the right knee forward to half kneeling position; on 2 the erect position is taken with the hands on the hips. From kneeling position one can also get into the erect position by tipping up into the spring sitting position and then stretching the knees.

Hands—down ! It has become common practice in gymnastics for girls and women to perform the exercise not as a trunk bending but as a leaning backward from the knees with the back quite straight. The centre of gravity lies so high, however, that one cannot lean very far before one loses one's balance, especially if the arms are in yard or ear position, two positions commonly used. The exercise is then very ineffective as an abdominal exercise. It might sooner be looked upon as a leg exercise as the extensors of the knees are doing the hardest work. This form of the exercise is consequently of little value.

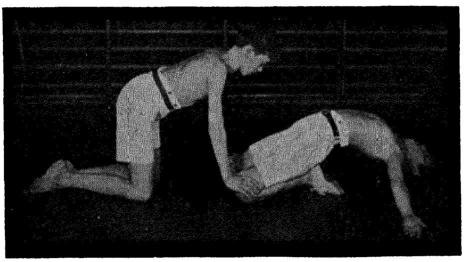


FIG. 164.

Common Faults. As given in 1; in addition, the lower part of the trunk is pushed back, so that the seat approaches the heels.

5. Wing Kneeling, Trunk Bending Backward to Floor. *To the floor backward—bend !* As in 4, but this exercise must always be taken with the ankles stretched; with the trunk bending there is a leaning from the knees, which increases the work of the abdominal muscles and stretches the extensors of the knees as strongly as possible.

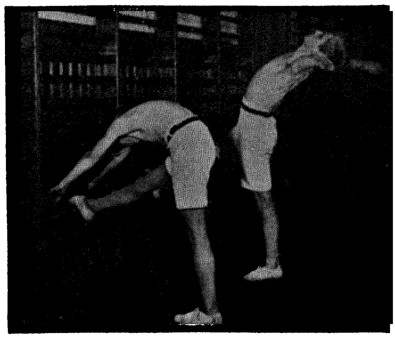
Beginners must be supported to prevent them from losing their balance. No. "twos" sit in front of No. "ones" in kneeling or kneel sitting position, placing their hands on their partners' knees (Fig. 164). As soon as No. "ones" have raised themselves up from the backward bend position, they put their hands on the knees of No. "twos," who then bend backward. In that way the changing may be done without loss of time.

When the exercise is done without support, the arms may be carried out to the sides during the bending. The hands, which are placed on the floor, help the pupil to keep balance and assist in the raising of the body in the return movement.

This exercise should not be taken with pupils who have a very flexible loin, nor with girls in the age of puberty either.

6. **Wing (Bend, Ear, Stretch) Fixed Standing, Trunk Bending Backward [Wing (Bend, Ear, Stretch) Arch Fixed Standing Position].** *Front towards, a long step away, to the wall bars—run! Left foot between third and fourth (fourth and fifth, etc.) bar—fix!* or *place!* or *support!* The left foot, raised straight forward and slightly turned out, is put in between the bars stated, the toes being put in on the lower bar and bent up against the next like a hook; both legs stretched, the standing leg vertical or, which is easier, oblique (with the foot farther from the bars than the hips); the chest parallel to the bars; the back well straightened.

Hips—firm! Trunk backward—bend! The trunk is bent strongly backward and should be moved so far back that the fixed foot has to hold fast in the bars to prevent the body from falling (Fig. 165). The lower part of the body cannot move forward counterbalancing the upper part of the body as in the standing trunk bending backward.



a FIG. 165. b

Upward—stretch! Foot changing—1—2. On 1 the left foot is put back to the right; on 2 the latter is fixed in the wall bars.

Foot and hands—down! Or only *Stand—erect!*

From bend position arm stretchings sideways and upward may be taken and from stretch position arm lowering to yard position together with a trunk bending backward or performed in the arch position.

If all the wall bar sections are occupied, No. "twos" must lean or bend the trunk forward while No. "ones" bend backward when the arms are in yard position (Fig. 165, b).

The exercise becomes harder the higher the foot is fixed.

In the position with the foot fixed in the bars, trunk leaning and bending forward towards the bars should often be taken, as this exercise strongly makes for mobility in the hip joint by stretching the hamstrings of one leg at a time. By grasping a bar near the foot and pulling, the effect is increased (Fig.

165, a).—Trunk bending backward and forward can also be done rhythmically.

The exercise may be taken with *living support.* No. "two" stands in lunge position with the left foot to the front. He presses the left foot of No. "one" firmly against the inner side of his knee, grasping the ankle with his right and the small of the leg with his left hand, the left forearm supported on his thigh. In the changing No. "one" swings his left leg in one movement backward to lunge position and No. "two" swings his right foot forward for support against No. "one's" right knee.

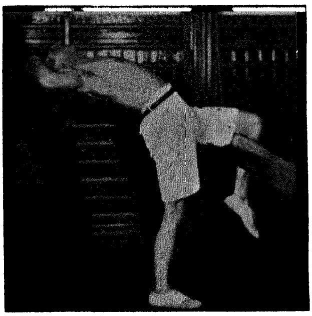


FIG. 166.

Whether taken at the wall bars or with living support, the exercise is also, in no small degree, a balance exercise.

Common Faults. As given in 1; in addition: (*a*) The fixed foot is obliquely out to the side instead of being straight forward; the balance is then easily lost in the bending.

(*b*) The fixed foot is turned too much inward and the standing foot too much outward; thus the body comes to stand obliquely to the wall bars. The bending is then half sideways and half backward.

7. Crook Fixed Standing, Trunk Bending Backward. Beam. The pupils stand facing a beam at about hip level. The leg is swung in front of the body and across the beam to crook standing position, the bent knee hooked on to the beam. A trunk bending backward as in No. 6 is performed. The position is firmer than with the foot fixed and the balance is more easily kept. Consequently, the trunk bending can be performed with more energy (Fig. 166).

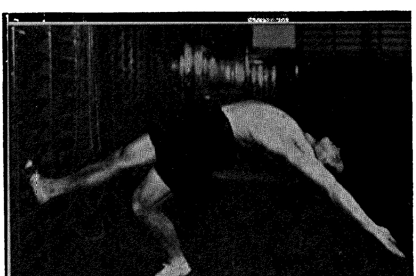


FIG. 167.

The changing of position may be done either by swinging the leg back and the other one over, or by placing both hands on the beam, one at each side of the knee, and with a jump and a turning about to the right, get into starting position on the other side with the right knee on the beam.

8. **Wing (Bend, Ear, Stretch) Fixed Standing, Trunk Bending Backward with Knee Bending.** When the starting position has been taken as in No. 6, the teacher commands: *With knee bending, trunk bending backward*—1—2. On 1 the body leans and bends backward, at the same time the knee is bent as much as one's muscular strength allows. Because of the knee bending a leaning before the trunk bending becomes possible. The exercise is a vigorous abdominal exercise as well as a strong leg exercise and a balance exercise too (Fig. 167).

B. Front Hand Lying

There are five degrees of front hand lying: *high, free, horizontal, deep* and *vertical.* The horizontal distance between hands and feet determines the exertion on the part of the abdominal muscles. The greater this distance is the more work for the abdominal muscles. The distance increases from high to free and from free to horizontal front hand lying, and it decreases from horizontal to deep and from deep to vertical front hand lying. In other words, horizontal front hand lying is the most powerful abdominal exercise within this sub-group. The weight carried by the arms increases through all the grades mentioned, a fact that is especially noticed during arm bending.

Front hand lying exercises mainly *develop strength.* When we go to and from the position with the feet kept together, the abdominal muscles work from a shortened condition to their normal length, as the pelvis—and with that the lumbar spine—has to be moved both when the legs are stretched backward and when they are drawn forward again (at least in high front hand lying). In the position itself the muscles work statically in normal length. The exercises may help to correct hollow back by shortening and strengthening too long and weak abdominal muscles, and in that way they may correct the carriage. But they do not in any way produce suppleness.

9. **High Front Hand Lying (High Front Hand Lying Position).** Beam, wall bars, forms, and so on. The apparatus first at knee level, later lower.

Front towards, half a step away, to the beam (wall bars, etc.)—run ! Front hand lying—1—2. On 1 the knees are bent so much that the pupils can just put their hands on the apparatus with at least shoulder-breadth's distance, thumbs on the nearest side of the beam, fingers on the other side. The body is vertical. On 2 the feet, kept together, are thrown back so far that the whole body is fully stretched, resting on the toes (underbent) and on the arms, which must be at right angles to the body.

From position—1—2. On 1 the feet are thrown forward and the knees bent so that the pupils come to the same position as in the first movement of the exercise, on 2 the body is raised to the erect position.

The position can also be taken in the following way : On 1 the left foot is moved backward with a bending of the right knee ; at the same time the hands are put on the apparatus ; and on 2 the right foot is moved back to the left. The return movement is done in the corresponding way by bringing first the left, then the right foot forward. This method is easier than the other because the pelvis and the loin are not moved ; accordingly there is less work for the abdominal muscles. Although this way of taking the position ought to be used now and then, it should not entirely take the place of the other and more powerful one.

With the hands supported at knee level the exercise is so easy that a lower support should be chosen before long. As long as the hands are even slightly above the floor and grasping an apparatus the exercise is a good deal easier than the free front hand lying.

In the front hand lying position clapping the hands may be practised. The hands push off so that the body is lifted a little, and after a clap are again placed on the apparatus ; it may be taken in individual rhythm. By this the pupils practise the push off, an important part of the exercise in many vaults and agility exercises, such as "head spring," "hand spring," etc.

Common Faults. (*a*) The feet are not thrown far enough back ; the shoulders then come forward over the apparatus.

(*b*) The knees are bent.

(*c*) The loin is hollowed and the hip-joints are fully stretched, so that the body hangs down in a curve.

(*d*) The hip-joints are bent, so that the seat is too high.

(*e*) The body is not kept high enough between the arms.

(*f*) The hands are too close together.

(*g*) The head falls forward.

Muscle Work (Fig. 168). In front hand lying position gravity will pull the lower part of the trunk down toward the ground by bending in the loin; this is prevented by the *abdominal muscles*, especially *rectus abdominis* and the *external and internal oblique abdominal muscles*, as these keep the distance between the ribs and the front of the pelvis sufficiently short. Stretching in the hip-joint is prevented by the flexors of the hips, especially *ilio-psoas*, and bending in the knee-joint by *quadriceps*. When the abdominal muscles and the flexors of the hips yield, the body sinks forming an arch. When the flexors

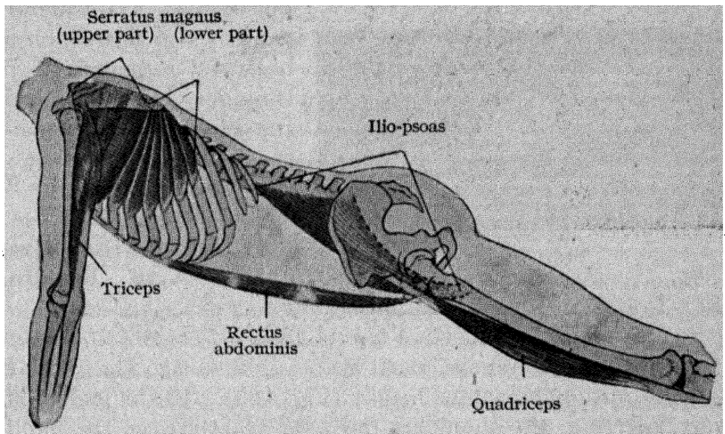


FIG. 168.

of the hips contract too much the hip joints are bent and the seat is pushed up. The trunk hangs between the arms, mainly borne by the upper and middle part of *serratus magnus*; this muscle works here in the same way as it does in four-footed animals, where the fore part of the body hangs in it, as it goes from the shoulder-blade like a broad band round the thorax. The arms are kept straight in the elbow-joints by *triceps*.

10. High Front Hand Lying, Foot Throwing Forward. High front hand lying position is taken as described in 9.

Foot throwing forward—1—2. On 1 the feet, kept together, are brought forward as in the first part of the return movement from high front hand lying position; on 2 they are thrown back to the starting position.

As the feet are thrown forward the pelvis is tilted so that the pelvic inclination is lessened and the loin rounded, demanding powerful work of the abdominal muscles during shortening. It is a valuable exercise, and it may be taken rhythmically, the pupils counting up to a certain number.

The legs may also be kept straight while they are thrown forward and backward by a slight give in the knees. In this form the exercise makes for suppleness, the more the lower the apparatus is. But the exertion on the part of the abdominal muscles and the flexors of the hip-joints becomes greater, too, on account of the resistance from the hamstrings; the position is similar to stoop standing position with the palms of the hands on the floor. A considerable work is also thrown on the outward rotators of the shoulder-blades because the trunk has to be lifted as in the first stage of hand standing with the feet together.

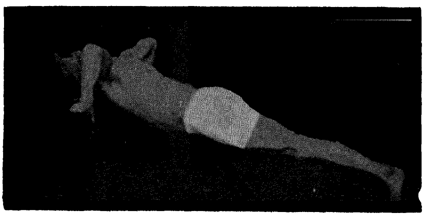


FIG. 169.

11. High Front Hand Lying, Arm Bending.

High front hand lying position is taken as described in 9.

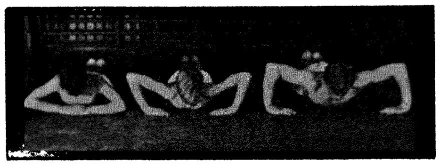
Arm bending—1—2. On 1 the body is lowered by a bending of the arms; the elbows must go straight out to the side and be held quite at shoulder height (Fig. 169). At the end of the body lowering, the shoulders must be exactly over the hands, and the upper part of the chest right down to the apparatus, so that the elbows are pressed well backward. The arms thus come nearly into the across bend position through the body lowering. The head is held well up. On 2 the arms are stretched.

The distance between the hands and the positions of the arms are of importance in relation to the work of the arms.

If we place *the hands one upon the other* (Fig. 170, a) the greater movement takes place in the elbow-joints and the lesser in the shoulder-joints, as the forearms are moved quite close to the upper arms which are pointed obliquely forward. The *triceps* has to do most of the work here, and one feels it. It is not advisable to train too much in this form of the exercise as it involves a marked shortening of the pectorals and thereby may cause bad carriage of the shoulders.

When we hold *the hands shoulder width apart* (Fig. 170, b) the movement takes place more equally in elbow and shoulder-joints. The elbow is not fully bent and the upper arm is moved into yard position. *Pectoralis major* assists greatly in the stretching of the elbow here. This form of the exercise is therefore easier.

When we place *the hands double shoulder width apart* (equal to the distance between the elbows, Fig. 170, c) the elbows are not bent much more than to right angles; the upper arm is pressed backward into yard position because of the position of the fore-arms, and the shoulder-blades are brought close together; accordingly the horizontal part of *pectoralis major* is extended very much. Here pectoralis major does most of the work, which is easily felt.



a b c
FIG. 170.

By grasping the apparatus so that the fingers, also the thumb, point forward or even outward, one can keep the elbows close to the sides during the arm bending. By this the pectoralis major is almost entirely put out of action and *triceps* has to do all the work. When the elbows are kept close to the body—they are apt to move away from the sides so that the pectorals may assist—the exercise is just as tiring as when the hands are placed one upon the other.

All four forms of the exercise are useful, and all of them should be practised.

Common Faults. As given in 9.

Muscle Work. In front hand lying, arm bending, the *triceps* yields evenly, and in the raising it contracts again. According to the position of the hands it is assisted more or less by *pectoralis major*, which muscle, aided by the *deltoid*, moves the upper arm from yard to reach position, and by that helps to stretch the elbow-joint. *Serratus magnus* works excentrically during the arm bending as the shoulder-blades are drawn together, and concentrically during the arm stretching, because the shoulder-blades are now drawn apart.

12. High Front Hand Lying, Arm Bending with a Fall against the Wall Bars. The pupils stand a long step away from and facing the wall bars. Keeping the body straight, they fall against the bars, grasp a bar at hip level, and break the fall by bending the arms. The arms are then stretched immediately and so forcibly that the body is pushed back to vertical position while the arms continue in an easy swing to drag position. Without any pause the pupils again fall forward, push off once more, and so on, until a halt is called. The exercise lends itself well to rhythmical work in an even, steady rhythm.

In order to secure room for the elbows during the arm bending, No. "ones" are a count ahead of No. "twos." The "twos" begin the fall at the moment the "ones" push off (Fig. 171).

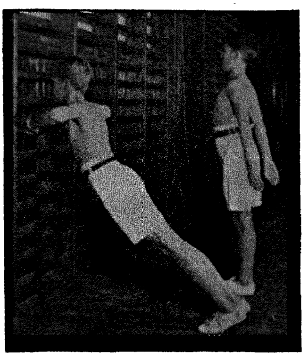


FIG. 171.

13. **Free Front Hand Lying (Free Front Hand Lying Position).** *Front hand lying*—1—2. On 1 deep knee bending is taken; the arms are brought forward and kept at shoulder-breadth distance with the hands against the inner side of the knees, palms facing one another. The trunk is vertical and the chest carried well forward between the arms. On 2 the hands are placed on the floor with the closed fingers pointing straight forward, and the feet are thrown backward; otherwise the position corresponds to that described in 9 (Fig. 172).

From position—1—2. On 1 the feet are brought quickly forward to the hands, which are taken from the floor, so that the pupils return to the same position as in the first movement of taking the position. On 2 the body is raised to the erect position.

The position can also be taken as described in 9, paragraph 3. In the first movement the right knee must be fully bent and placed outside the right arm.

Finally, the position can be taken in a third way. From spring position the pupils travel forward on their hands to front hand lying and back again to spring sitting position. The arms are here doing most of the work.

In free front hand lying position one should not omit the hand clapping described in 9.

Also a jump on all fours off the floor may be practised; in that case the legs are kept apart as in stride position.

Common Faults. As mentioned under 9.

14. Free Front Hand Lying, Foot Throwing Forward. As described in 10 and performed both with bent and with straight knees.

With the knees *bent* the feet may, to begin with, be moved forward one at the time, the knees outside the arms, but thrown back together. It may be done in time, counting 1—2—3; 1 and 2 as the feet are placed forward, 3 as they are thrown back together. When the feet are kept together in the forward as well as the backward movement it may be done to counting up to a certain number, *e.g.*, 9. On 9, the feet may be thrown right forward between the arms, almost as in a between vault on the horse, the legs are stretched fully and the body rolls backward to back lying position. This exercise demands agility and suppleness, for the legs have to be bent fully in hips, knees, and ankles, and the knees have to be drawn right up to the chest during a full contraction of the abdominal muscles. From the back lying position free front hand lying may be resumed by a quick turning about, after which the foot throwing forward is repeated.

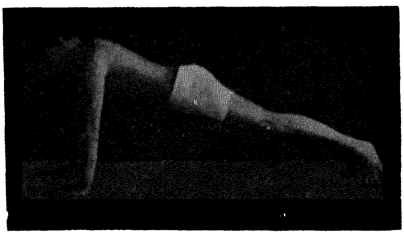


FIG. 172.

The exercise may also be done in such a way that the feet are alternately thrown backward, being kept together, and apart into stride position with the legs almost at right angles to the body. The exercise may be done in time to four counts: 1 and 2 for the foot throwing forward and straight backwards; 3 and 4 for the foot throwing forward and astride. In the stride position the adductors are extended, accordingly mobility in the hips is increased.

When the foot placing is taken with straight knees the feet may be moved forward to the hands by a series of small steps or jumps, but thrown backward in one movement, feet kept together. When the pupils are sufficiently supple and strong, the foot throwing forward is also done in one movement (Fig. 173). The exercise is tiring, especially so because of the hard work on the part of the abdominal muscles. Very few exercises demand the same complete shortening of these muscles; accordingly it is one of the very effective exercises against hollow back.

Here, also, the feet may be thrown backward and astride alternately.

15. **Free Front Hand Lying, Alternate Arm Raising (Leg Raising).** When *arm raising* is taken the hands should be close together in the starting position, fingers pointing straight forward. *Arm raising*—1—2 (the left arm)—3—4 (the right arm). The arm is raised to stretch position, otherwise the position of the body is unaltered. Beginners may keep the feet astride as this makes it easier to keep the balance; arm raising may then be taken in time with a slap of the hand against the floor.

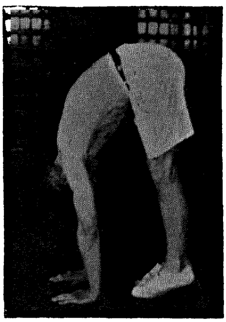


FIG. 173.

For *leg raising* the hands are kept shoulder width apart. *Leg raising*—1—2 (left leg)—3—4 (right leg). The leg is raised till the foot is level with the shoulders. The movement takes place in the hip-joint and, when that is fully extended, in the loin by an increase of the pelvic inclination. It will thus be understood that the leg should not be raised too high.

The opposite arm and leg may be raised together. *Arm and leg raising*—1—2 (left arm and right leg)—3—4 (right arm and left leg). The hands close together. This exercise is a pronounced balance exercise.

16. **Free Front Hand Lying, Arm Bending.** Free front hand lying position is taken as described in 9.

Hands inward—turn! Arm bending—1—2. The hands are turned inward so that the fingers point towards each other, after which the arm bending is taken as described in **11**, **p. 296** and following. As regards the position of the hands, the four forms of the exercise described in 11, **Fig. 170**, should be used also here. When double shoulder width is used the elbows will not be moved relatively so far back as in the corresponding high front hand lying because the lower part of the chest touches the floor. This form produces suppleness of the wrists by bending them very far back, and this fact is worth while remembering as many people have too stiff wrists.

Even in its easiest form strong arms are required for this exercise. Beginners should therefore start the exercise in front lying position. They place their hands in the correct position opposite the shoulders and while stretching the arms lift the body from the floor, the whole body being kept straight and the whole front leaving the floor at one time. After arm bending they rest a moment in front lying position. Keen and well disciplined pupils may work freely. When exercises are almost beyond one's power it is unsatisfactory and a handicap to have to work together with others, whether they are stronger or weaker than oneself.

If one is not able to keep the body straight it is better to raise the hips somewhat by a bending of the hip-joints than to allow the body to sag.

Common Faults. As in 9.

17. **Free Front Hand Lying, Arm Bending with Alternate Leg Raising.** *Arm bending and leg raising*—1—2 (left leg)—3—4 (right leg). As in 15 and 16. The leg raising increases the work both of the abdominal muscles and the arm muscles.

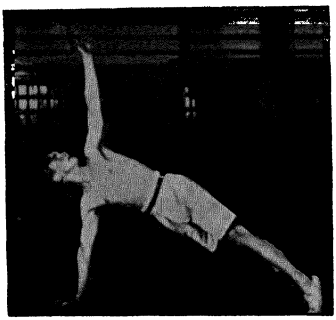


FIG. 174.

18. **Free Stride Front Hand Lying, Alternate Arm Raising Sideways with Trunk Twisting.** *Arm raising sideways with trunk twisting*—1—2 (left arm)—3—4 (right arm). As the trunk is twisted, or rather turned, the arm is moved up to vertical position. The legs are kept astride (Fig. 174). The twisting of the spine is very slight. The axis of the movement runs from the supporting shoulder-joint towards the pelvis, which is turned a fair amount with the body. It cannot be fixed in this position as the legs are not fixed. The exercise is not considered a trunk twisting for this reason.

19. **Deep Front Hand Lying (Deep Front Hand Lying Position).** Wall bars, beam.

Back against, to the wall bars (beam)—run! A long step forward—march! With the feet at hip height (on the beam), deep front hand lying—1—2. On 1 the first movement of free front hand lying is taken, on 2 the hands are placed on the floor with the fingers forward; after this the feet, one at a time, are put up on a wall bar at hip height (or on the beam) (Fig. 175). The body is stretched, the head bent slightly backward, the arms about at right angles to the body—that is, rather under the body.

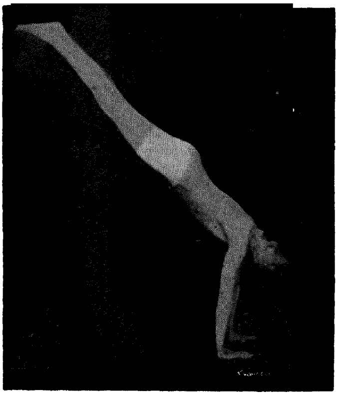


FIG. 175.

From position—1—2. On 1 the feet, kept together, are brought down to the hands as in 13, and the erect position is taken again.

Instead of wall bars or beam *living support* may be used. No. "two" stands behind No. "one," bends his hands backward and receives his partner's legs one at a time, gripping the instep, the thumbs inward. By raising or lowering the hands No. "two" can make the front hand lying more or less deep. By stepping close up to No. "one" he may raise him to hand standing position, to which this is an easy introduction. During the return movement No. "two" must help his partner to keep the feet together.

In the deep front hand lying position *arm bending* may be practised. As the shoulders describe a curve where trunk and legs are radius the hands should be so near the apparatus that the arms are at right angles to the body. In order to give the arms less work to do one may hook the feet on to the apparatus, and in that way carry part of the weight of the body.—If the feet are sufficiently high up the teacher may command: *Trunk lowering*—1—2. The body is lowered without any arm bending, the arms simply give in the shoulders. By that the arms are brought to stretch position, and the position of the body is *reverse arch hanging*, in which the body is half-way hanging down from the toes (Fig. 176). The pectorals are here strongly and passively extended. If the "heaving muscles" are strong

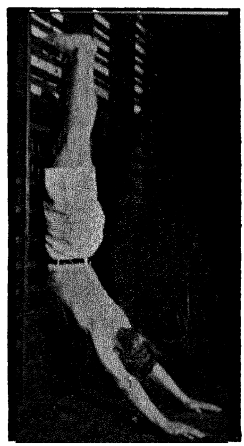


FIG. 176. — Reverse arch hanging.

enough the body may be raised to the starting position without any bending of the arms during the return movement. As the arms are moved from stretch to reach position the movements of the shoulders are similar to those in hanging body raising, so this part of the exercise may justly be called a heaving exercise. In this latter exercise the hands must be farther away from the apparatus than in the previous arm bending.

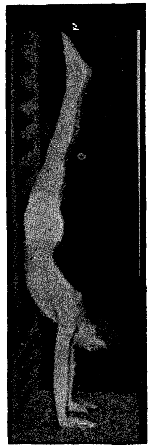


FIG. 177.

20. **Vertical Front Hand Lying.** Wall bars. *Back against, to the wall bars—run! One step forward—march! Vertical front hand lying*—1—2. On 1 the first movement of front hand lying is taken; on 2 the feet are moved, either one at a time or after sufficient practice, both together, as high up in the wall bars as possible, while the hands at the same time are moved in towards the bars till they are about a foot-length's distance from them. Trained pupils can keep the legs away from the bars so that only the abdomen is supported against them. The head is bent well backward (Fig. 177). The exercise is a good preparation for hand standing.[1]

From position—1—2—3. On 1 the hands are moved a step forward from the bars to give the feet room to come down; 2 and 3 are taken as the return movement from deep front hand lying position.

[1] The Ling system has many stooping exercises, exercises with the head downward. P. H. Ling called the exercise half forward circling in two ropes "reversing," an exercise used a great deal in curative gymastics both by him and Branting. Of Branting (Ling's successor as Principal of the Central Institute and the father of the Swedish statesman) it is said that he practised head standing several times daily in order to "flush the brain." Hjalmar Ling, in his "Theory of Movement," has a chapter on stooping exercises, and he says that there are more and a greater variety of them "in the system evolved in the north" (the Ling system) than people abroad would expect in a system "so cautious." And he adds in another book of his that as soon as a healthy boy sees a horizontal beam at a suitable level he will throw himself on to it and circle round it.

Probably a healthy instinct lies behind it when children and young people are so fond of stooping exercises. Little children like to roll head over heels, older children to do cartwheeling, walk on their hands, etc. Whatever the explanation these exercises will increase the blood pressure in the vessels of the brain, and by that the vessels will be developed and strengthened. The one who has trained his body through physical exertion has better blood-vessels than the one who has always led a sedentary life. The former uses his blood-vessels more than the latter, and the rule,

C. Knee and Leg Raisings

Back lying and hanging, knee and leg raisings on the one hand and sitting, trunk leanings backward on the other, are alike in so far that both groups involve work of the abdominal muscles and large movements in the hip-joints. The difference between the two groups is that in the case of knee and leg raisings the thorax is the fixed part from which the abdominal muscles work, and the pelvis moves; in trunk leanings backward the pelvis is the fixed part and the chest moves.

In both groups of exercises the abdominal muscles work hard as they have to carry or move in one case, the legs, in the other, the trunk, the arms, and the head. It should be noted, however, that in back lying position it is far easier to raise the legs 90 degrees from horizontal to vertical position than it is in hanging position to lift them 90 degrees from vertical to horizontal position.

When we except sitting, trunk bending backward to the floor, the abdominal muscles are in these exercises working statically at their normal length, or concentrically or excentrically in a shortened condition. To prevent or correct hollow back these exercises are amongst the very best as they shorten the abdominal muscles and make them stronger; and at the same time it ought to be mentioned that trunk bendings downward are the best means of extending the posterior ligaments and muscles of the loin if they have become shortened.

"use develops its tool," holds good for blood-vessels too People who never turn themselves upside down need not grow very old before they are unable to endure having their heads downward. On the other hand, if one keeps up this exercise from youth and if one's organs are healthy, one can with advantage, for example, stand on one's hands up to an old age.

It happens that children, especially girls, suffer from headaches after stooping exercises. These children must not be forced to do them, they may be suffering from ear trouble and should see a doctor. (If the child cannot balance on one foot as easily with the eyes shut as with the eyes open there may be ear trouble.) When the doctor has declared the child fit, he or she may gradually be trained up to do stooping exercises so that these cause neither headaches nor giddiness.

The æstheticism within gymnastics for women has almost done away with stooping exercises, not only for adult women and big girls, but also for little girls (probably because many, more or less consciously, look upon the exercises as a display). Girls should have a greater number of stooping exercises in the gymnasium than boys because they have fewer opportunities of getting them outside the gymnasium.

21. Stretch Back Lying, Knee and Leg Raising. *On the back—down!* Back lying position is taken through deep knee bending by putting the seat on the ground just behind the heels, stretching the legs forward, and lying back on the floor; the arms in the stretch position with the edge of the hands pressed against the floor.

There are different degrees of the exercise.

(*a*) **Stretch Back Lying, Knee Raising and Stretching.** *Knee raising and stretching*—1—2—3. On 1 the knees are raised till the thighs are about vertical. On 2 the legs are stretched, at first vertically upward, later obliquely forward at an angle of about 45 degrees to the floor. On 3 the legs are lowered. The exercise may be done in time with or without counting aloud.

The exercise is made harder by not allowing the legs to touch the floor when they are lowered; the work goes on without the rest obtained by placing the legs on the floor for a moment.

(*b*) **Stretch Back Lying, High Knee Raising and Stretching.** *High knee raising and stretching*—1—2—3. On 1 the knees are raised as high up towards the chest as possible. On 2 the legs are stretched vertically upward or even obliquely upward in above the head. On 3 they are lowered with or without a slight rest on the floor before the exercise is repeated as described in (*a*).

By grasping the bottom wall bar it is easier to raise the knees high up.

(*c*) **Stretch Back Lying, Alternate Leg Raising.** *Alternate leg raising—begin!* Left leg is at once raised as high as possible while the right leg remains stretched along the floor. At the same time as the left leg is lowered the right leg is raised, and they pass one another about half way. This is continued in an even, steady rhythm until a halt is called. If the arms are held in reach position the pupils may aim at touching the hand with the foot in each leg raising. The above single leg raising may alternate with a double leg raising keeping time by saying: *Left—and—right—and—both—and,* and so on.

(*d*) **Stretch Back Lying, Leg Raising.** *Leg raising*—1—2. The exercise may be taken in four degrees as *slight, half, vertical,* or *high* leg raising; the form chosen must be indicated in the command.

In a *slight* leg raising the legs are lifted only a few inches off the floor; in *half* leg raising about 45 degrees, in *vertical*

90 degrees, and in *high* leg raising right in over the head so that the toes reach the floor. When grasping the bottom bar the feet, with the knees slightly bent, may be placed against one of the lower bars. On the command: *Stretch!—bend!* and so on, the knees are stretched and relaxed a few times. This gives to the hamstrings and the lumbar extensors of the back a strong passive stretching. By a full stretching of the knees the pupil gets into reverse stoop position as here the feet have been moved to the hands (Fig. 178).

With the arms by the side, the legs and the trunk may be raised simultaneously from the floor, each of them about 45 degrees, so that one only rests on the seat. This is best introduced from crook sitting position with the hands on the knees. The lower legs are lifted in line with the thighs, at the same time the trunk leans a little backward with straight back, and the arms are carried to yard position, the trunk and the legs now nearly at right angles to one another. This angle sitting position is also a kind of balance exercise.

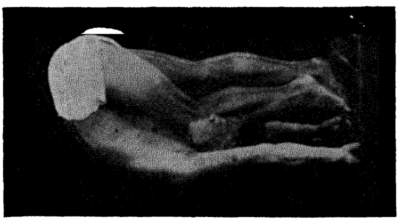


FIG. 178.[1]

The erect position is taken from the back lying position on the command: *From position—up!* The pupils raise themselves quickly to cross sitting position with the legs drawn well up, and in one continuous movement they stretch their legs, if necessary push off with the hands, and jump to the erect position.

The Importance of the Exercise and the Muscle Work. As already stated, in hanging, knee and leg raisings the higher the raising the greater the work, whereas the opposite is the case in the back lying position. In this latter position the work is hardest in a *slight* leg raising with straight knees because the lever on which the weight of the legs acts (the horizontal distance from the hip-joints to the centre of gravity of the legs) is the greatest. The higher the legs are raised the shorter it becomes.

The muscles raising the leg by a bending of the hip-joint are *ilio-psoas*, *rectus femoris*, *pectineus*, *adductor longus* and *adductor*

[1] The film exposed twice, while the knees were bent and while they were stretched.

brevis, *tensor vaginæ femoris*, and *sartorius*. These muscles, all coming from the pelvis, will, by their pull on it, turn it in a backward direction (*i.e.*, increase the pelvic inclination), and by that hollow the loin, to which hollowing the *ilio-psoas* contributes directly by its pull on the lumbar spine. The muscles that turn the pelvis in the opposite direction (decrease the inclination) must therefore fix the pelvis ; these muscles are *rectus abdominis*, the *external* and *internal oblique abdominal muscles*.

In a slight leg raising the abdominal muscles act only very little from the outset, and the consequence is that the back is hollowed, a fact which one readily observes by placing a hand under the loin. If one wishes to avoid this hollowing of the loin one has to contract the abdominal muscles before the leg raising begins, straighten the loin, and press it down against the floor, and keep the muscles sufficiently contracted right from the beginning of the leg raising.

Beginners, particularly children, cannot control their abdominal muscles sufficiently for this. And it is for that reason, amongst others, that we make them begin with a knee raising which demands much less work on the part of the flexors of the hips. The pull on the pelvis by these muscles will be so slight that it is easily counteracted.

When the leg raising has exceeded 45 degrees, the loin will begin straightening itself on its own, because the hamstrings will now be tightened, and their pull on the ischial tuberosities makes the pelvis move with the legs during the raising. This will take place, although to a lesser extent, also when the knees are bent because the posterior part of the adductor magnus, from the ischial tuberosity to the inner femoral condyle, will also be tightened by extension and will act like the hamstrings muscles, although it does not pass the knee. The pull on the front edge of the pelvis by the abdominal muscles will naturally help in a turning of the pelvis and a straightening of the loin too.

When the legs are lifted to the vertical, their centres of gravity are just above the hip-joints, and their lever is thus equal to 0. All the same the abdominal muscles and the flexors of the hips have to work, and the reason is that they must overcome the pull caused by the extension of the hamstrings. Owing to their elasticity they exert a pull on the legs in a downward-backward direction, the shorter they are the greater the pull. To this must be added that only the very supple are able to raise the legs to the vertical by a movement in the hips alone and without lifting the pelvis from the floor; and this lifting of the pelvis must be done by the abdominal muscles.

The difference in the length of the hamstrings in the very stiff and the very supple is considerable, in fact, so great that the stiff person can only bend his hip-joint about 45 degrees, whereas the supple one can bend his about 90 degrees.

In a *high* leg raising the legs have to be brought quite close down to the head before the abdominal muscles relax, although one might think that the weight of the legs alone would be enough to turn the pelvis. But the leg raising does not take place now by a movement in the hips, it is done by a strong bending of the lumbar and soon also of the dorsal spine. The rear border of the supporting area is now brought close up to the shoulders, and, until the common centre of gravity for the legs and the lower trunk has passed this border line, the abdominal muscles have to work.

Beginners find it easier by high leg raising to keep the arms along the sides than to keep them in stretch position, for by pressing the arms against the floor they help to raise the legs and the pelvis. The muscles brought into action here are *latissimus dorsi* and *teres major*, together with the *adductors of the shoulder-blades*, thus the very same muscles which in standing position bring the arms in drag position. The arms are now the fixed point for the muscles while the trunk is moved.

By a high leg raising the abdominal muscles are fully shortened.

As the abdominal muscles in the back lying, knee and leg raisings have less and less work to do, the higher the legs are raised, the exercise is not strenuous, and very short training is needed to enable the abdominal muscles to perform the work demanded of them with ease. In order that the exercise may have any effect on the further development of the abdominal muscles the movements must be repeated a great number of times. We can also choose other and harder exercises, such as hanging, knee and leg raisings; and sitting, trunk leanings and bendings backward, where the work of the abdominal muscles increases with the increasing movements of the hips.

22. Stretch Grasp Standing, Double (High) Knee Raising (Crook Hanging Position). *Back against, to the* *wall bars—run! At stretch height bar—grasp! Knees (high)—raise!* The knees are raised together so high that the thighs are horizontal; the lower legs are kept vertical, the feet closed with ankles stretched (Fig. 179). During the movement the pelvis must be against the bars, so that the bending takes place in the hip-joints alone. Accordingly, the abdominal muscles are working statically.

The knee raising may be practised in time, first in individual time, later in joint time, stopping in the crook hanging position. As long as the children are untrained individual time should be used. When they are not made to work together the weak ones will find time to raise their knees better than if they had to keep together with their stronger class mates.

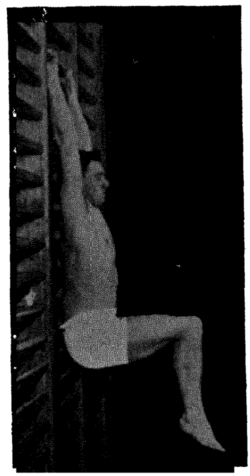


FIG. 179

The exercise can be introduced as a *single knee raising. Alternate knee raising*—1—2—3—4. On 1 left knee is raised as high as one is able when the right leg has to be kept fully stretched along the wall bars; the pelvis is fixed by the right leg being held against the bars, and the whole movement must take place in the hip-joints. On 2 the left leg is stretched downward. On 3 and 4 corresponding movements with the right leg. The exercise may be done to the following counting, 1—*and*—2—*and*. On 1 left knee is raised, on *and* it is lowered; on 2 right knee is raised, on *and* it is lowered.

The one knee may also be raised at the same time as the other one is lowered. The counting is then 1 for the raising of the left knee, 2 for the lowering of the left and the raising of the right, 1 for the lowering of the right and the raising of the left, and so on.

Single and double knee raising may also be combined. First a single knee raising with each leg is taken, then two double knee raisings in succession. The exercise is taken in joint time to the following words: *Left—and—right—and—both—and both—and*, and so on. All the lowerings are done on *and*. In this way the abdominal muscles rest during the single knee raisings, and are able to work so much the harder during the double knee raisings.

In the *high* knee raising the knees are raised as high as possible towards the chest. Strong and supple children may almost touch the face with the knees. In this case the pelvis has to be lifted away from the wall bars and the back is rounded, especially the loin. (Fig. 180).

This knee raising may be taken in time too, first individual time, later joint time, and it may be combined with single high knee raising as above. In single high knee raising the lower leg must leave the wall bars somewhat.

Common Faults. (*a*) The knees are not raised high enough.

(*b*) The lower legs are not kept vertical, but are most often in under the thighs.

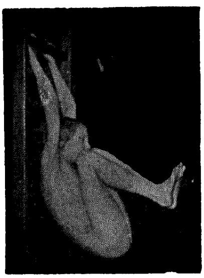


FIG. 180.

(*c*) The knees and feet are parted.

(*d*) The head falls forward.

Muscle Work. The muscle work in crook hanging position is generally the same as in angle lying position (p. 306 and following). The centre of gravity for the raised legs and the pelvis together will endeavour to sink down under the point of suspension, in this case the loin. As the pelvis cannot move back because of the wall bars, the lumbar spine will move forward, pulled forward by *ilio-psoas* ; in other words, the back will be hollowed unless the abdominal muscles prevent this by pulling the anterior edge of the pelvis upward, and thus lessening the pelvic inclination. The abdominal muscles exert a downward pull on the ribs corresponding to the upward pull on the pelvis ; but the ribs are not lowered by this pull because they are fixed by the *pectoralis major and minor*, which carry no small part of the body's weight in the hanging position.

If hanging knee and leg raisings are practised on the beam, without support for the back, the body will swing backward till the centre of gravity (situated in front of the abdomen because of the position of the legs) is vertically below the hands. In order to raise the legs to the horizontal the angle between the legs and the trunk must be less than 90 degrees, and consequently the abdominal muscles must lift the pelvis, and with it the legs, a little higher than in the corresponding position in the wall bars. This means a greater shortening of the muscles, and is felt as a considerable additional exertion.

23. Stretch Hanging, (High) Knee Raising (Crook Hanging Position). *Back against, hang from the top bar—up! Knees (high)—raise! Knees—lower!* As described in 22.

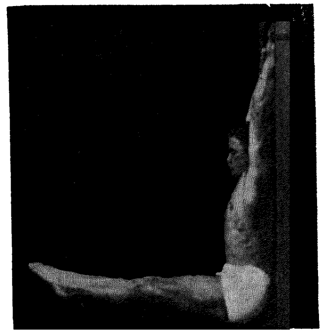


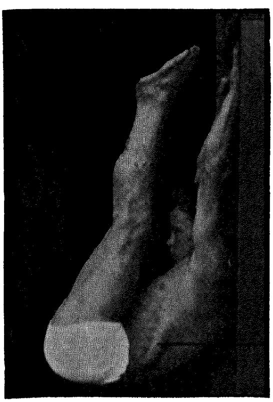
FIG. 181.

From position (or *Deep jump*)—*down!* The legs are swung strongly forward, and stopped by a pull of the extensors of the hip, by which the body is moved away from the bars; the hands then let go, and the landing is taken as far forward as possible, while the arms are brought forward-downward as in an arm swinging. This landing should first be practised from stretch grasp standing position.

Common Faults. As given in 22.

24. (High) Crook Hanging, Knee Stretching. The starting position is taken as described in 22 and 23.

Knees—stretch! Knees—bend! On *stretch* the knees are fully stretched as far as possible without being lowered and without the hips leaving the bars (Fig. 181). If the stretching is taken after high knee raising, the aim should be to get the legs as high up as possible (Fig. 182), after which, especially at first, the pupils can be told to lower the legs as slowly as possible down to the wall bars. For pupils who are not very strong, the three movements must follow each other quickly. But strong and supple pupils may put the toes under the bar which the hands are grasping and by alternate full stretching and slight bending of the knees produce a strong extension of the lumbar extensors of the back and the hamstrings in a reversed stoop position as mentioned (Fig. 178,



Edge of latissimus dorsi.

FIG. 182.

p. 306). The legs are lowered slowly and with straight knees. By making a halt when the legs are horizontal the pupil demonstrates how the abdominal muscles have full control over the movement.

Common Faults. (*a*) The thighs are lowered during the knee stretching so that the legs are not horizontal.

(*b*) The arms are bent a little. In that way the "heaving muscles" are able to assist the abdominal muscles more.

(*c*) The head falls forward.

25. Stretch Hanging, (High) Leg Raising. The starting position taken as in 23. (*High*) *leg raising*—1—2. On 1 the legs, fully stretched, are raised to the horizontal without the hips leaving the wall bars. It is more difficult to reach the horizontal position in a leg raising than in a knee raising, and consequent stretching, as described in 24. The reason is that it is easier for the flexors of the hips to overcome the downward pull of the hamstrings when the thighs have reached the horizontal position before the knee stretching than when their pull has to be overcome at the same time as the stretched legs are being raised.

High leg raising is done most easily if the legs are put into full swing right from the outset; but the exercise is not fully mastered till one is able to raise the legs slowly. When the legs are vertical their leverage is so small, that the flexors of the hips have only slight work to do to hold them; it is now the abdominal muscles that have to do the greater work, together with latissimus dorsi, particularly its anterior portion running as a thick band (see Fig. 182) from arm to pelvis and helping to pull the pelvis, and with it the legs, forward-upward. The best training for the flexors of the hips, especially ilio-psoas, is obtained by leg raising to the horizontal, and alternate leg raising is probably the very best, as the pelvis here is kept still so that the whole movement takes place in the hip-joint, making the flexors of the hip contract fully.

Hanging, knee and leg raisings are excellent exercises for developing the abdominal muscles, and thus helping to give the lumbar region of the trunk its correct posture. It has become a custom to practise knee and leg raisings after span bending, and this is all to the good and should be encouraged. Span bending stretches the dorsal spine, makes the chest mobile and strengthens the adductors of the shoulder-blades. Knee and leg raisings straighten the loin and develop the abdominal muscles, thus benefiting the organs of digestion and keeping them well supported. The one who practises these two sets of exercises and continues doing so is likely to preserve a good carriage and healthy lungs and digestive organs.

D. Sitting, Trunk Leanings and Bendings Backward

In order to understand the movements taking place in a sitting, trunk leaning backward, one must remember that the ischial tuberosities reach down to about 3 inches below the middle of the hip-joints. The tuberosities are curved like rockers, and it is on those we sit and move when we lean backward from the vertical position. If from the long sitting position on the floor with the heels against a wall we let the body lean backward to back lying position, the hip-joints will move according to a curve having as radius the vertical distance from the floor to the middle of the hip joint in the starting position, and the heels will accordingly be drawn about 4 inches away from the wall. In the return movement they slide forward again. Here we may look upon the tuberosities as the fulcrum not considering that they are rockers, where the fulcrum is moving.

When the feet are fixed so that the heels are held firmly against the wall the hip-joints will be the fulcrum. Accordingly, the tuberosities must slide forward on the floor while the trunk moves backward ; and this sliding they do quite easily—firstly, because of the thick layer of fatty tissue covering them, and secondly, because the clothing under the seat slides across the floor fairly easily.

In a gymnastic trunk leaning backward with the feet fixed the pupils are able to make the ischial tuberosities the fulcrum by having the knees somewhat bent in the starting position and then stretching them during the leaning. The hip-joints are then moved backward with the trunk. If, on the other hand, the pupils sit with straight knees and feet fixed, the hip-joints will be the fulcrum and the ischial tuberosities must slide forward during the leaning. As already stated, they do that readily when one is sitting on the floor, but when untrained pupils are doing the exercise on stools or forms they may fix the pelvis towards the end of the leaning by making the flexors of the hips work statically instead of excentrically, and when the pelvis is fixed the trunk can only be moved further backward by a bending in the loin. If the teacher makes the pupils start with straight knees he must have his attention directed to this fault and correct it when it occurs.

The most common forms of the exercise are: a leaning of 45 degrees, a leaning with a bending to the floor, and a leaning to the horizontal; here stated in the order of difficulty. In each case the difficulty may be increased by adopting arm positions in which the arms are raised higher and higher.

For beginners it is preferable that the arms are kept by the sides. With the hands they may grasp the edge of the apparatus, in which case the arms by pulling may lessen the work of the abdominal muscles and the flexors of the hips. When the exercise is taken rhythmically this arm position is particularly good for beginners and pupils who are less strong.

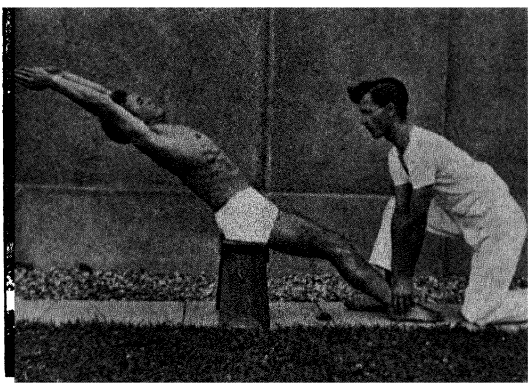


FIG. 183.

26. Wing (Bend, Ear, Stretch) Fixed Sitting, Half Trunk Leaning Backward [Wing (Bend, Ear, Stretch) Half Fall Fixed Sitting Position]. Stool, form, beam, floor (or grass), with the feet fixed in the wall bars up to the height of the apparatus used, or with living support.

"*Ones*," *sitting position—place!* (or *sit—down!*) "*Twos*"—*support!* The "ones" sit well forward on the stools, and at the same time fix the feet between the two lowest bars, or on a separate command are supported by "twos"; these take crook kneeling position so far forward that the arms are vertical (Fig. 183). The knees of the "ones" must be stretched or slightly bent, the trunk vertical, back well stretched, head high. Arms in the position required.

Trunk half backward—lean ! With a good stretching of the trunk and some pressing backward of the head the trunk is slowly inclined backward to an angle of about 45 degrees with a movement in the hips alone ; if the knees were slightly bent in the starting position they are stretched during the movement.

Upward—raise ! From position—up ! With the arms in wing position it is a common fault to place the hands too far behind because in that case the arms, like two props, help to carry the trunk ; the position will also cause hollow back.

In bend position arm stretchings sideways and upward may be practised. If the wall bars are used and every section occupied, every other pupil must lean forward and every other one lean backward to make room for the arms in arm stretching sideways.

In connection with trunk leaning backward a trunk bending forward grasping the bar can be taken. By a pull of the arms the head and trunk can be brought very far down towards the knees, and this will mean a strong stretching of the lumbar extensors of the back and the hamstrings. By lifting oneself from the stool one may increase this effect.

Trunk leaning backward and trunk bending forward can be done in time, to begin with in individual time.

Common Faults. (*a*) The trunk is not stretched before the leaning begins.

(*b*) The back is rounded and the head falls forward in the leaning and in the return movement. The tendency of rounding the back is especially great because the work of the abdominal muscles and the flexors of the hips becomes much smaller when the loin is rounded. This rounding makes the trunk shorter, its centre of gravity will be lowered, the distance from the abdominal muscles in front to the lumbar spine increases, which means better leverage for the muscles and consequently less work. Also the work of the flexors of the hips will be less because there will be an increased distance between their origin and insertion. This is due to the smaller pelvic inclination, caused by the rounding of the loin, this holds good especially as regards the *ilio-psoas*, when its insertion on the loin is moved backward.

Muscle Work. In the leaning backward (falling) the muscles working in the hip-joint are the flexors—especially *ilio-psoas* and *rectus femoris*. As gravity causes the leaning, they work excentrically, as the trunk goes back, and concentrically as it is raised. Gravity will pull the trunk backward by a bending in the loin; this must be prevented by the *abdominal muscles, rectus abdominis,* and the *external and internal oblique muscles.* The strong downward pull of these muscles on the ribs will round the back; this is the most common fault in the exercise; erector spinæ, therefore, must keep the back stretched just as in trunk bending backward (p. 282).

27. **Wing (Bend, Ear, Stretch) Fixed Sitting, Trunk Bending Backward (to the Floor).** Stool, form, beam, with living support, or with the feet fixed in the wall bars. The starting position is taken as described in 26.

Backward to the floor—bend! First the whole trunk is moved backward, leaning from the hip-joints; when the movement

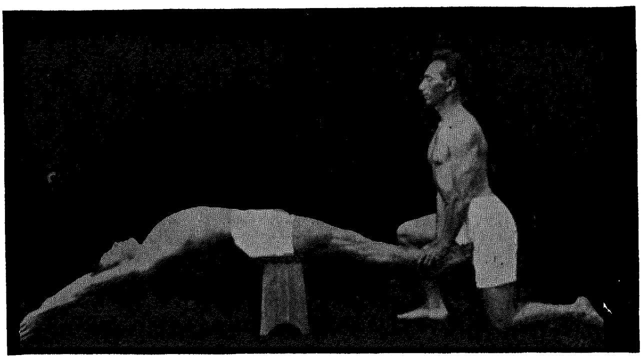


FIG. 184.

in the hip-joints is at an end, the back is bent as far backward as possible (Fig. 184).

Upward—stretch! The trunk is raised slowly and stretched up with the head held well back and the chest forward.

From position—up!

This exercise, with a trunk bending forward added, lends itself well to work in individual rhythm, but the arms must be held in positions suited to the strength of the pupils.

Common Faults. As given in 26.

28. **Wing (Bend, Ear, Stretch) Fixed Sitting, Trunk Leaning Backward.** Stool, form. The trunk leans backward as far as the mobility of the hips allows, *i.e.*, to about horizontal position. Stopping in this position and then raising the trunk

without otherwise altering its position demand very strong abdominal muscles (Fig. 185).

Executed on the floor with the feet fixed under the bottom bar the exercise is easier because of the rest obtained in the back lying position. If the knees are strongly bent the flexors of the hips have to work in a very shortened condition (Fig. 186).

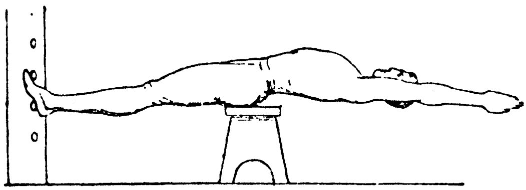


FIG. 185.

29. Back Lying, Trunk Bending Forward. Trunk bending forward and leaning backward may be done on the floor without support. One has then to dispense with the straight carriage of the trunk, and both during the bending forward and the leaning back one must round the body so much that the legs are not tipped up by the trunk. Back lying position is generally chosen as starting position, and the exercise is done in time, individual time or joint-time, and fairly quickly. The trunk is raised with a jerk and one tries to touch the feet with the hands during the bending forward. One can also hit the palms of the hands against the floor beside the feet; this may act as a stimulus to the whole class. The backward movement is performed with a round back so that the trunk rolls into the back lying position. The arms may be kept along the sides or carried up over the head towards the end of the movement and placed along the floor in stretch position. In that case the forward bending begins with a quick swing forward of the arms in order to help the body up during the raising.

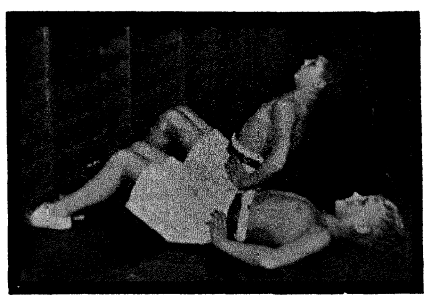


FIG. 186.

It is a good training exercise for the abdominal muscles working in a shortened condition.

E. Game-like Exercises

30. **Four-Standing, Travelling Forward on the Hands to Front Lying Position.** From four-standing position the children travel quickly forward on the hands to front lying position and back again. The exercise is a preparatory exercise for front hand lying. By stretching the arms forward and raising them from the floor in front lying position a good dorsal exercise is combined with a good abdominal exercise.

31. **Jumping up from Front Lying Position.** The children take front lying position on the floor. The teacher commands : *Up !* The hands are put on the floor below the shoulders, the arms are stretched, and the legs drawn up to the hands as in returning from free front hand lying, though with free form ; then the erect position is taken quickly. Performed several times in quick succession it is an exercise with life and go. Also here, as in 30, the children may stretch their arms forward and lift them from the floor in front lying position in order to add a dorsal exercise to the other. This addition need not prevent one from taking the exercise in a lively manner.

32. **Crawling and Running on all Fours.** The children are formed up at the wall bars. They go down on all fours, crawl or run across the gymnasium playing at *dogs*.

They can also race one another across or along the hall, or run an obstacle race over forms, low beams, etc.

The children may also amble heavily and slowly like *bears*, knees straight, the hands a little in front of the feet. The steps should not be too short. The body sways from side to side ; while swaying to the right the left hand and the left foot are moved, and vice versa.

33. **Jumping Up from Back Lying Position.** (*a*) When the teacher stands in front and gives the signal, the children jump up facing her by raising the body and quickly drawing the legs up and pushing off with the hands.

(*b*) If the teacher gives the signal from behind, the children roll quickly round to front lying position and jump up facing the teacher, as described in 31.

34. **Changing between Back Lying and Cross Sitting Positions.** From back lying position cross sitting position is taken, and it is important to remember that the back must be stretched well, the children making themselves as tall as possible in the sitting position. The hands are placed lightly on the knees. As the children lie down again they stretch their legs forward as a counterweight to the trunk. Is first taken to command. The children must be kept a little while in the cross sitting position in order that the teacher can make sure that their backs are straight. Later the exercise is taken in joint-time; but also here there must be a pause in the cross sitting position.

A trunk bending forward may be added so that the children go from the back lying to the cross stoop sitting position in one continuous movement. Little children are fond of large movements.

35. **The Little Drum and the Big Drum.** The children are in back lying position. On the command : *The little drum is beaten !* alternate slight leg raisings are taken during which the children hammer their heels against the floor. It is done so quickly that it reminds one of the roll of drums. May also be taken from the crook back lying position, in which case the children drum with the soles of the feet.

If the teacher says : *The kettle-drum is beaten !* the legs are lifted alternately about 45 degrees and the heels beaten against the floor. The time as in quick marching.

On the command : *The big drum is beaten !* the legs are raised alternately to vertical position, and by a stretching of the ankle and a slight bending of the knee the sole of the foot is beaten hard against the floor. Slow time. A few beats can also be taken with the feet together and both legs lifted simultaneously.

36. **Back Lying, Leg Circling.** The children lie on their backs, raise the legs to vertical position, part them as much as possible, and move each leg in a big curve sideways till the feet meet again, after which the legs are raised, and the whole is repeated. The exercise is taken in individual time. The adductors are stretched well in this exercise.

37. **Back Lying, Cycling.** The children lie on their backs, take up the starting position by raising one knee towards the chest and lifting the other leg, kept straight, slightly from the floor (Fig. 187). On the word : *Cycling—go !* the legs are moved as in cycling, sometimes slowly, "uphill," sometimes quickly,

"downhill," and yet in big movements. "Free-wheeling" may also be taken now and again, the legs are then held as in the starting position. The children may put their arms in reach position as if "grasping the handle bars," they may "ring the bell," etc.

38. **Stretch Hanging, Cycling.** The children are suspended from the wall bars, back against. Otherwise the leg movements are as in 37. Each knee should be lifted at least so high that the thigh is horizontal and the foot should be carried well forward in the stretching of the knee. The larger the movements the greater the work (compare p. 308 and following).

39. **Long Sitting, Rolling.** From long sitting position with the hands on the floor beside the hips the children roll backwards carrying the legs with them, first to vertical position, later so far over that the feet touch the floor behind the head. After the return movement a pause is taken sufficiently long to enable the children to stretch the back well and sit erect. The exercise is first taken in individual time, later in joint-time.

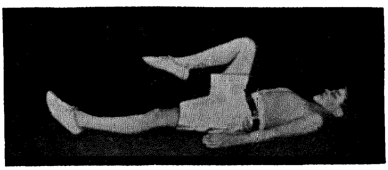


FIG. 187.

About cross sitting, rolling, see p. 164.

40. **Hare Hopping ("Bunny-Jump").** From spring sitting position the children hop in short hops forward on hands and feet. After some practice the hops are made longer, and then the children throw themselves forward as far as possible on their hands, and bring the feet up again with a quick jump and hip bending. Each "hop" follows the other without pause. When the children have gained some skill they can compete in "hopping" a given distance either as quickly as possible or in as few "hops" as possible.

After some practice one "hop" at a time may be taken on the command: *One hop—go!* The aim may be either a long "hop" or a steady position in the landing, or both.

The "hopping" may be done over some piece of apparatus. Each child tries, for example, to "hop" forwards and backwards across a stool, the stool either lying on its side or standing. The jump must be long so that the feet can clear the apparatus. The teacher may ask the children to finish a long jump or "hop" not on all fours but in the spring sitting position. A low vaulting box, a class-mate lying on hands and knees, a low beam, or a rope, may also be used as obstacles. By making the obstacle higher the exercise becomes more difficult. The children are least afraid of the rope.

Hare hopping backwards should also be practised. Here the feet should be lifted first, and as high as possible. While they are being lowered the arms push the body backwards and the hands leave the floor in a smart push off as the feet are put down. The body is now in spring sitting position. The "hops" are not very long nor are they supposed to be. The energy has to be put into the raising of the feet and the push off with the hands.

The hare hopping exercises are not only good abdominal exercises, they are also good preparatory exercises for the arms as regards many vaults, hand standing, agility exercises, etc.

41. **Creeping.** From four-standing position with the hands some distance in front of the feet the children creep forward, moving hands and feet crosswise, *i.e.*, left hand and right foot together, and vice versa. The steps should be long, the foot placed forward close up to the hand of the same side, the knee outside the arm. Taken first by numbers. When taken in time it should be done so slowly that the various movements can be carried out fully.

42. **Walking like a Seal.** In front hand lying position the children move forward using the hands alone and dragging the feet after them. The body waddles from side to side as the weight of the body is shifted from one hand to the other, a movement similar to that of a seal walking on land. It is a powerful exercise, especially for the arms. The children may compete in walking a given distance, *e.g.*, to a chalk-line across the hall.

43. **Crab Walk.** Taken in open order from stride front hand lying position. The children move sideways a few yards, lie down on their front for a rest, and move back again. The balance is most easily kept when hands and feet are moved cross-wise, left hand and right foot together. It is therefore useful to begin from the front hand lying position with the feet apart.

The children may compete in twos, starting at one end of the hall, head towards head, and each one trying to reach the other end of the hall first.

44. Prone Kneeling, Crosswise Arm and Leg Raising. In prone kneeling position, with a good distance between hands and feet, arm and leg are raised backward crosswise, *i.e.*, the left arm is carried to stretch position, while at the same time the right leg is raised and stretched backward in line with the body. The position is changed with a slow movement.

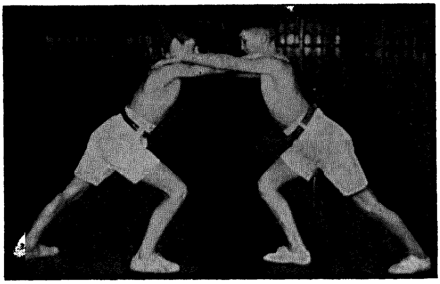


FIG. 188.—"Pushing to the wall."

45. "Pushing to the Wall." The children stand in 2 lines facing each other. The left foot is put forward as in a lunging. The pairs put hands on each other's shoulders. On a given signal each tries to push his opponent over to the wall (Fig. 188). The children can also be told to grasp each other's elbows, which are then held somewhat bent. This gives the arms more work.

46. Driving Wheelbarrows. The children stand in 2 lines with arm's distance between the pairs and with two steps' distance between the lines. The children in the first line take stride front hand lying position. The children in the second line go in between their legs, grasp these just above the knees if the children are small (Fig. 189), around the ankles with older children, and lift them vertically upward without pulling them backwards, otherwise the "wheelbarrows" fall down on their chests. If the grasp is above the knees, the legs are most securely held when the drivers put them over their hips and press them in against their sides with the upper arms ; this greatly lessens the work for the "wheelbarrows." After some practice the movement can be taken in time with beating on

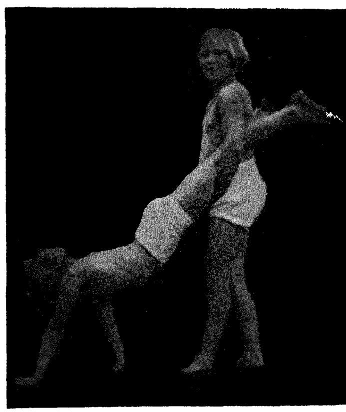


FIG. 189.—"Wheelbarrow."

the floor; they can also turn from marching forward in ranks to marching forward in files.

If the children are well disciplined they may play the game "the heavy wheelbarrow." The "wheelbarrow" resists the movement forward by pressing the hands firmly against the floor, by turning aside, now to the one side and now to the other. The one pushing the "barrow" will try to overcome his resistance by gripping well over the knees, and in the struggling pressing the legs firmly against his own sides.

After sufficient practice the "wheelbarrows" can be left in hand standing position against a wall, or in knee hanging position on a beam at the right height; in the latter case the hands can then be taken from the floor and placed on the hips, and a trunk bending backward can be taken in addition (Fig. 190).

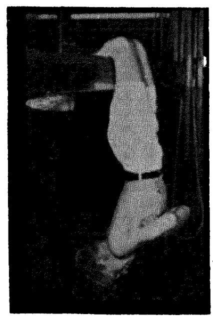


FIG. 190.

§ 21. Dorsal Exercises

As most people have their work in front of them they must move the trunk forward in order to do their work. In most cases this movement takes the form of a forward bending of the back, especially the loin, with a small leaning forward in the hip-joints only. And this stooping position is common to most of our work, however varied it may be.

Work puts a stamp on people, not so much the work itself as the positions in which it is done, and especially that which is common to the different working positions, the round back. When the round back is fixed the body has received a stamp of heaviness, stiffness and lack of freedom and ease.

This stamp may be found not only in the physical worker, but also in the mental worker, who sits bent over his books or his papers; and not only in adults do we find it, but in the school child as well, when it begins spending part of its day at the school desk.

If a twig is bent and tied up it will grow crooked, and something similar will happen to the child that sits daily during the many years of growth at the school desk in a bent position. Its back will grow round; muscles, ligaments, and finally bones, will adapt themselves to the position like the fibres of the bent twig, and the position will be fixed for good (see p. 115). This change of structure takes place the more easily the less the individual moves and develops his muscles. The muscularly slack collapse more easily when sitting than the strong. The way in which a person sits generally indicates what his posture will be like when standing.

A strong back may also be round, however. A navvy has a strong back because of his heavy work, but it is often round too. When he holds his back rounded during his work and forgets to stretch it well afterwards his dorsal extensors will be permanently lengthened, and this affects the carriage of the back, which is maintained by unconscious work of these muscles.

A good posture depends not only on strong dorsal extensors, but these muscles must also be accustomed to keeping the body erect.

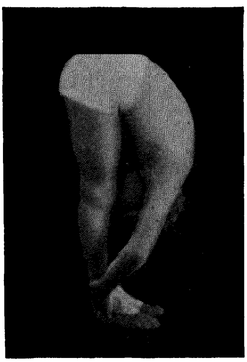


FIG. 191.

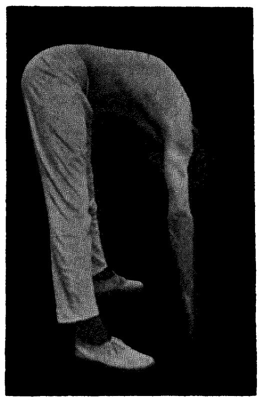


FIG. 192.

There is one special type of round back which gymnastic teachers ought to know, and it will therefore be described here.

During a trunk bending downward a normally developed back will to the onlooker present a fairly even curve, as seen in Fig. 191, which shows a normal back. But many young people have backs that do not bend in an even curve like that in stoop position. In such, a part of the loin is stiff and straight or even concave (Fig. 192). The dorsal spine shows a marked rounding in a fairly limited region, as a rule, with the 6th, 7th or 8th dorsal vertebra forming the top of the curve (Fig. 192). This region of the dorsal spine is completely stiff; it can be bent neither forward nor backward and can be influenced neither by ordinary gymnastics nor by curative gymnastics. Fig. 193 shows Fig. 192 in erect posture. The curve of the loin is exaggerated and the dorsal spine is round, but when clothed the poor posture will not be very noticeable, although it is unusually pronounced. Milder grades of this type are very common, and they are easily recognised in stoop position by the stiff loin and the marked rounding of a limited part of the dorsal spine.

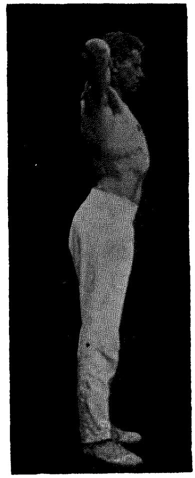


FIG. 193.

The Danish physician, H. Scheuermann, has found the cause of this deformity of the back.[1] He found that most youths suffering from it have acquired it during adolescence, or perhaps even earlier. They stated themselves that it had arisen in connection with heavy bodily work, which stands to reason as by far the greater number of them were young farm hands. In most of them the round back developed within a space of 6 months or a year, with a few within merely 2 or 3 months. Some were able to state a special exertion on a given day as the cause of it.[2] Most of the cases are young men, very few are girls, and it is often in strongly developed individuals that this deformity is found, which is

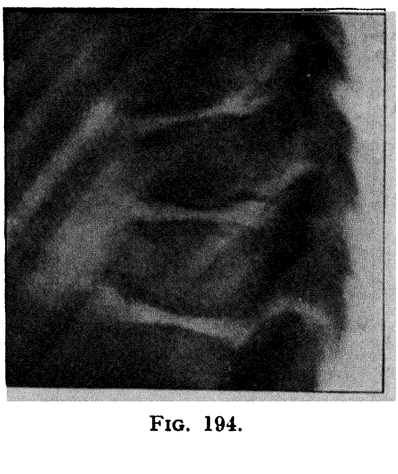


FIG. 194.

[1] Described in his article, "Kyphosis dorsalis juvenilis" (juvenile round back) in *Ugeskrift for Læger*, March 18th, 1920, from which the X-ray photos are taken by kind permission of the author.

[2] Figs 192 and 193 are pictures of a young man who, one day at the age of 14, felt a sharp and sudden pain in his back just as he lifted a milk pail weighing about 1 cwt. from a cart on to the platform at the creamery. He was unable to work for about a week, but did not go to a doctor. After that he took up his work again but the round back now began to develop very quickly.

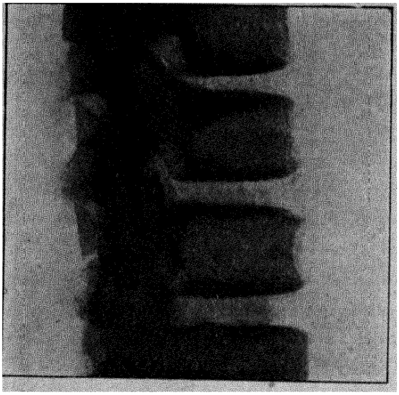


FIG. 195.

understandable as they are often only too willing to exert themselves and show what they can do.

X-ray examinations of the spine in fresh cases show that the intervertebral discs and the epiphysial cartilage in some vertebral bodies, as a rule only three, have been injured, as shown in Fig. 194, representing the injured vertebræ in a 14-year-old boy in whom this form of round back is developing. The bodies are uneven and irregular on the surface and are taking on wedge-shape. By a comparison with Fig. 195, showing the normal vertebræ in a 16-year-old boy, one sees clearly the difference between injured and healthy vertebræ and the difference in thickness of the intervertebral discs. Fig. 196 shows the vertebræ of a 16-year-old boy in whom the process has run its course and where the round back has been fixed by the marked wedge-shape of the vertebral bodies. One will readily understand that this type of round back cannot be corrected. Apart from this the back may be strong enough and able to stand work and physical exercise. Mobility above, and particularly below, the stiff and rounded region of the back may be developed, but the region itself remains absolutely immobile.[1]

FIG. 196.—Fixed round back; vertebræ wedge-shaped.

This form of round back

[1] It may be mentioned that a corresponding deformity may be found in colts that have been ridden too soon. Some of their vertebræ will be wedge-shaped with the narrow edge upward; in other words, their backs will be hollow. The horse cannot stand heavy work either till it is full-grown.

is an additional evidence of the fact that the age of puberty is a period in which the growing organism may receive permanent injury from a heavy exertion, however brief. Parents and employers should remember that youths at the ages of 15 and 16 cannot stand the same heavy work as those of the age of 25, not even if they are strong and well developed, and not at all if they are weak and anæmic and suffering from backache.

Not only parents and employers, but also teachers, must realise their responsibility as regards the bodily development of the children, and not only the gymnastic teacher but *all* teachers. They are the children's "employers" during their growth, and the teachers' influence affects the body too. They may all do their part in counteracting the bad influence of the many hours' sedentary work (compare p. 10 and following). They must know that poor sitting posture tends to deform, and they must make a point of training their pupils in good habits as regards sitting. It is clear that the children cannot sit erect throughout the whole lesson. They must be allowed to alter the position now and then, otherwise they will grow tired. Even a slight alteration puts other muscles or parts of muscles into work and a certain relief is felt. Unfortunately, the position which the children are able to keep up the longest is the one in which they collapse, the longer they have been used to this bad position, the easier it becomes for them. But this position must be corrected, and fortunately, by practice the good posture may also become a habit, and it may be kept with ease and comfort when the extensors of the back are sufficiently trained and strengthened (see p. 129).

Poor posture with round back is so common in all work, whether done walking, standing (Figs. 197 and 200), or sitting (Fig. 199) that there must be certain causes for it. There are, and they are easily found.

Firstly, very few have properly developed dorsal extensors, *i.e.*, extensor muscles of proper strength and proper medium length. We cannot blame Nature. The extensors of the back are originally strong muscles. It is surprising to see how strong they are in babies even from birth in spite of the curved position in which the fetus is developed.

Secondly, the posture with round back during work feels easier than with straight back, especially when the dorsal muscles are weak. The back is shorter when it is rounded than when straight, which means less leverage for the weight of the body. Already this means less muscular work. To this must be added that when the back is rounded it is held up *passively* by the extension of the various ligaments and extended muscles and by the support from the compressed abdominal viscera (p. 78). When lifting heavy weights the pressure on

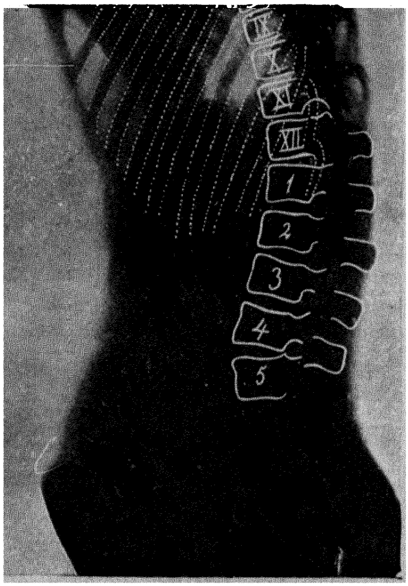


FIG. 197.—The loin in a poor working position.[1]

the abdominal viscera may be so great as to cause inguinal rupture (hernia).

Not only can we find the causes, we can also find the ill-effects

[1] FIG. 197 shows the lumbar spine and the 4 lower dorsal vertebræ of a 14-year-old boy standing bent forward in a bad working position. His round back goes as far down as to the 4th lumbar vertebra ; there is no normal lumbar curve ; the 4 upper lumbar vertebræ can even form a curve convex backward instead of forward. The lumbar curve is limited to the junction of vertebræ 4 and 5, and probably the junction of No. 5 and the sacrum, but this cannot be seen in the picture. The intervetebral discs between the vertebræ from the 12th dorsal to the 3rd lumbar are compressed in front. The spinous processes of the corresponding vertebræ are spread apart compared to those in Fig. 198. The ribs are sloping more and are closer together in Fig. 197 than in Fig. 198.

of poor posture. By the rounding of the dorsal spine the ribs are lowered and the room for the lungs is made smaller. The increased curving of the spine is always accompanied by stiffness. The mobility of the chest is therefore lessened and the breathing becomes less full; in other words, the work of the lungs is hindered. By the rounding of the loin the upper trunk is carried forward and the chest with the diaphragm lowered upon the intestines (Fig. 199, b). This will interfere with the free movements of the diaphragm, and, as stated previously the viscera have to carry part of the weight of the trunk.

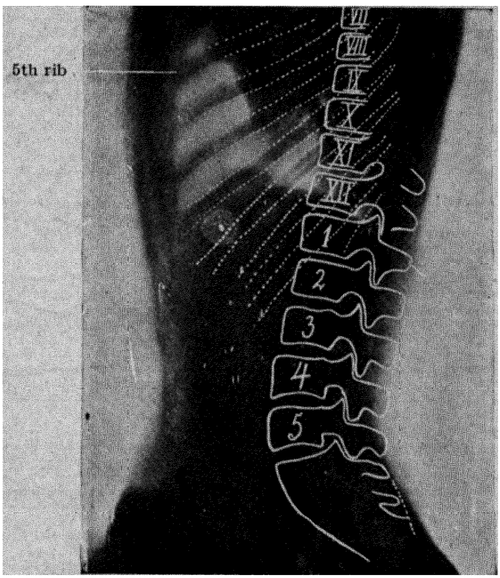


FIG. 198.—The loin in a good working position.[1]

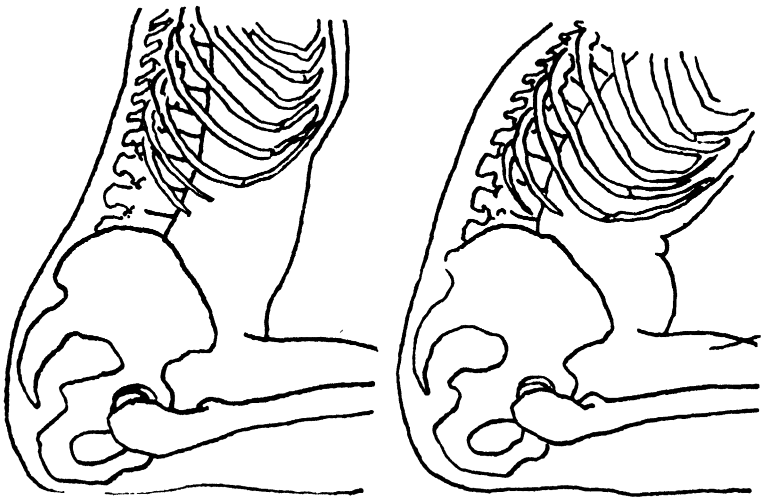
The pressure thus exerted on the viscera will interfere with the activity of the abdominal organs and help to cause indigestion

[1] Fig. 198 shows the same spine in a good working position. Here the lumbar spine is slightly curved forward. The ribs are raised so much that the anterior end of the uppermost rib in the picture, No. 5, is level with the 9th dorsal vertebra. In Fig. 197 the anterior end of the uppermost rib in the picture, No. 3, is level with the 10th dorsal vertebra. This shows to what extent the thorax, and with that the diaphragm, is lowered on to the abdominal viscera in a bad working position.

of the kinds so often found in clerks and other people with sedentary work. Particularly older people will find it a relief, especially after a meal, to sit with a straight loin (Fig. 199, a).

It will be seen from the above that it is the vital organs of chest and abdomen that suffer when a poor posture is kept during work.

The object of dorsal exercises is to develop the extensors of



a FIG. 199.[1] b

[1] Figs. 199 and 200 show the difference between good and bad working positions, sitting and standing. In Figs. 199a and 200a, the abdominal cavity is long, the chest and diaphragm are raised. In Figs. 199b and 200b, the abdominal cavity is short, compressed and broad ; the chest is lowered. and through the diaphragm the upper trunk is partly resting on the viscera. The ribs are lowered and the chest cavity diminished.

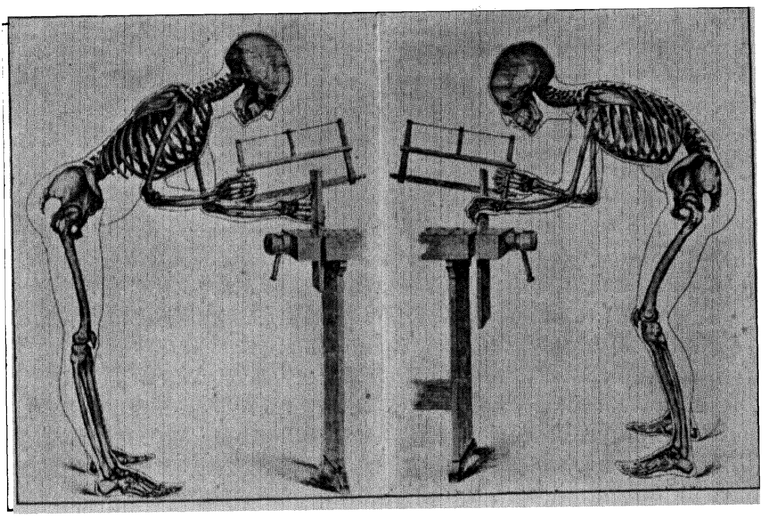
Man's erect spine is supported at its lower end only, whereas the spine of the four-footed animals is supported at both ends, one end by the hind-legs, the other by the forelegs. Chest and abdomen suspended from this horizontal spine are not subject to the same alterations as in man. A horse always works in a "good working position," as its chest and abdomen do not alter as to shape and its organs of breathing and digestion are not impeded during work.

Man, who has to balance his spine on the pelvis, may keep it straight or crooked in good or in bad postures during his work.

It depends on the strength of his dorsal extensor muscles and upon their accustomed medium length which of these positions he may have during his work. As sure as the straight position is better than the crooked, so sure it is that man does not deserve to have the upright position, if he does not develop his dorsal extensors to that extent for which they are made by Nature, and which enables them to support the upper part of the body during work throughout life.

the back and give them their proper strength as well as their proper medium length. And, as explained before, it will be seen how important this task is, especially during the years of development and growth.

The erector spinæ belong to the groups of muscles that maintain the erect posture, These groups are: the calf muscles, the extensors of the knees, the extensors of the hips, the erector spinæ, and the other muscles at the back of the neck; and the muscles of these groups are the largest and strongest in the body, far larger and stronger than their antagonists, which a comparison will show us. Beginning from



a FIG. 200. b

below, the anterior muscles of the lower leg are antagonists to the calf muscles, the flexors of the knees to the extensors, the flexors of the hips to the extensors of the hips, the abdominal muscles to the erector spinæ, the anterior neck muscles to the posterior ones. When the postural muscles are stronger than their antagonists, this is due to the work they are put to; consequently we cannot speak of a lack of harmony.

In parts of the body we do find muscles where the muscles in question and their antagonists are equally strong; *e.g.*, the adductors and the abductors of the leg, the flexors and extensors of the arm, and in the shoulders the muscles that stretch the arms upward, and the muscles that pull them downward; but this is only in accordance with the use we make of them.

In the forearm again there is a great difference in strength between the flexors and extensors of the fingers. We should not forget that, but stretch the fingers well the few times we have an opportunity of doing so during a gymnastic lesson. It is æstheticism carried too far when we always demand a slight bending of the fingers in the various arm positions.

As a matter of course more powerful exercises are needed for developing large muscles than small ones; yet this rule is often overlooked by many gymnastic teachers. They think they have done their duty when they put in a few dorsal exercises at suitable places in their tables. Whether the exercises chosen are able to develop the large dorsal muscles properly is not considered. One can even hear expressed the opinion that by including a span bending in every lesson the pupils are given a double dose of dorsal exercises, and that one is overdoing the training of the dorsal muscles at the expense of the other trunk muscles.

There is no risk of giving the dorsal muscles too much work to do during a gymnastic lesson. On the contrary, they generally have too little work to do.

Firstly, there are not many powerful dorsal exercises proper. The most powerful one is front lying, and it is used far too little. Trunk leanings and bendings forward are easy exercises; they have to be repeated very often before the dorsal muscles feel any exertion; lunging is hard on the legs, not on the back.

Again, the spirit of competition cannot so easily find expression in dorsal, as, for example, in abdominal exercises. Take, for instance, hanging, high knee raising and stretching, or upward circling on the beam. These exercises are so difficult that the pupils are quite ready to compete with one another. It is a pity that dorsal exercises do not lend themselves to competition because the dorsal extensors above all ought to be strong and enduring.

The rhythmical method of work, with its many repetitions making easy exercises effective, has been a great gain for the dorsal exercises. This method should therefore be used extensively here.

It is only right to express a warning against the extensive use made nowadays of the exercises extending the dorsal muscles as compared to those which shorten those muscles.

Firstly, there are many more exercises that bring the body into stoop position than exercises that bring it into arch position. Secondly, trunk bendings lend themselves more readily to rhythmical work, and therefore give an air of life and go to the lesson, and in that way impress spectators. But the true teacher must not look upon his exercises as a display; he must keep the proper aim of gymnastics before him, a healthy bodily development. Accordingly, he must counteract the stooping positions of daily life by laying stress on exercises that develop the dorsal extensors and make them work hard in a shortened condition.

Compared to the exertion on the part of the dorsal muscles in connection with many occupations of daily life, carrying weights, digging, etc., the exertion of the same muscles in the gymnasium is not great. When the dorsal exercises may prove effective all the same this is due to the fact that they make the dorsal muscles work from their greatest lengthening to their greatest shortening. By that the proper medium length may be secured and this results in a good carriage.

The heaviest work of the erector spinæ is undoubtedly produced during exercises other than dorsal exercises, *e.g.*, in running, jumping and vaulting. Not only four-footed animals, but also human beings, use their backs in running and jumping. In agility exercises, such as "head spring," "hand spring" and "back spring," the dorsal muscles are used strongly too. But we cannot do without the dorsal exercises proper, producing suppleness and correcting poor posture as they do.

When a region of the back becomes stiff, atrophy of the muscles belonging to it sets in, just as it does with the flexors and extensors of a stiff elbow. It is easily felt that the muscles of a stiff back are not as full as those of a mobile back. That which is not used deteriorates.

Dorsal exercises were called exercises for back, shoulders and neck in the Ling system. This name indicates that the muscles along the back right up to the back of the head are affected. In most dorsal exercises the body is brought into or near the horizontal position, giving increased work to the cervical extensors carrying the head, weighing about 8 lbs., especially when the trunk is swung up and down. Dorsal exercises may be looked upon as powerful neck exercises too. By keeping the head in its proper position, *e.g.*, in trunk leanings forward and in trunk bendings backward in front lying position, these exercises will also help one to hold the head erect habitually.

Also the shoulder muscles work hard in many dorsal exercises. Arm stretchings, arm flingings and arm swingings are more fatiguing in lean standing and front lying than in standing position. The suspension of the shoulders from the lower cervical vertebræ by trapezius IIa (p. 178 and following) means also that a better carriage of the spine will result in a better carriage of the shoulders.

A. Trunk Leanings Forward

1. Wing (Yard, Ear, Stretch) Stride Standing Trunk, Leaning Forward [Wing (Yard, Ear, Stretch) Stride Lean Standing Position].

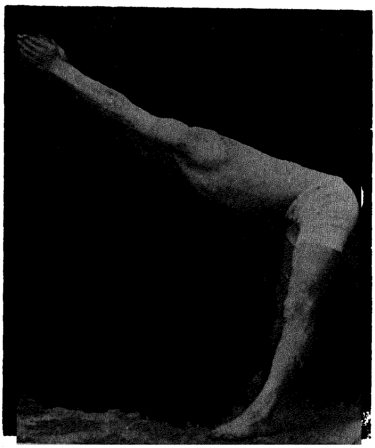


FIG. 201.

Forward—lean! By a bending exclusively in the hip-joints the trunk leans slowly forward. For the sake of balance the body moves a little backward by a movement in the ankle-joints (Fig. 201).

The back must be straight as in erect position, and no movement or only the very slightest, must take place in the spine; the curve of the loin is rather diminished than enlarged. Consequently, the chest and the abdominal cavity are unaffected; the ribs and the diaphragm can move freely; the wall of the abdomen is relaxed, and the organs in these cavities are not hindered in their activity. The latter freedom, more than anything else, demonstrates the need for making this position a matter of habit during work, whether standing or sedentary.

The head should be kept as in the erect position, slightly more lifted, but with long neck so that the chin does not poke. The knees are fully stretched. The leaning should be carried as far as the hamstrings allow; one should feel a marked tension at the back of the legs, especially behind the knees.—To secure a free carriage of the head a head turning may be added.

Upward—raise! The trunk is raised slowly, still well stretched, to the starting position.

When the movement has been learned it should be taken rhythmically, either by raising the body up to the vertical in each movement and fairly slowly, or by performing small pulling movements further and further downwards in the lean position. But in both cases the back must be kept straight with no bending whatever.

Some teachers are so afraid of hollow back that they even fear too much hollowing of the loin in lean position. In their opinion one should make use of the exercise as a corrective to hollow back by making the pupils round the loin towards the end of the leaning. This, however, is completely wrong, as in that way the exercise loses all value as a training in good working position. Besides, the fear of hollow back is in this case groundless. Only the very supple are able to hollow the back in lean position and that only very slightly. And if they lean forward as far as the hamstrings allow any hollowing is quite out of the question.

All exercises developing the extensors of the back prepare the way for good working positions by giving the muscles strength and endurance. And trunk leaning forward is without comparison the best of this kind, as it trains one directly in the position required and makes the taking up of this position quite a habit. The lean position is in itself the working position, slightly exaggerated; it is seldom that we have to lean so far forward at our work as in this exercise. The position so commonly adopted with a round back while at work deforms the body more than any other, and by its bad effect on the organs of the chest and the abdomen it undermines health. It is clear, accordingly, that trunk leaning should be taught with care and should be used extensively in our gymnastics.

Stride position provides the firmest starting position, and it enables one to lean still more forward. As it is also easier for beginners to perform the exercise correctly in this position it should be used first. But later, *standing, close standing* and *walk standing positions* can be used.

The most important arm positions in connection with trunk leanings are *bend, yard, ear* and *stretch position*. The higher the arms are put the higher the centre of gravity for trunk, head and arms together and the longer leverage for the weight of the body, but this means increased work for the extensors of the back. To this should be added that the muscles keeping the shoulder-blades in position are also given greater work during the different arm-positions in lean position, and this is of importance too. The one who is able to keep the arms in a good stretch position while leaning forward has mobile shoulders and strong shoulder muscles.

Common Faults. (*a*) Head falls forward, or it is bent too far back.

(*b*) The back, especially the loin, is rounded (Fig. 202).

(*c*) The knees are bent.

(*d*) When arm stretching sideways is added, it is a common fault in the yard position to lower the arms considerably below shoulder level. In that way the good effect on the posture of the shoulders is greatly lessened (compare p. 172 and following).

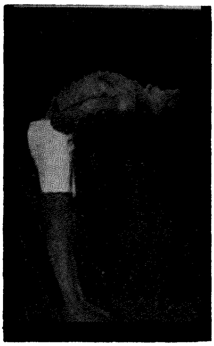


FIG. 202.

(*e*) Arms fall forward in the stretch position.

Introduction. Trunk leaning forward is a simple and uncomplicated exercise and yet very difficult for beginners to perform correctly. From daily life we are so used to carrying the body forward at work by a rounding of the back more than by a movement in the hips. Both teacher and pupil have to be very attentive in order to get away from this ingrown habit, which will manifest itself when the trunk leaning is practised.

In many people the hamstrings are so short too that they check the movement in the hip-joints long before the trunk has reached the horizontal. If in that case the teacher encourages his pupils to go further down they have to round the loin. He must, therefore, let the pupils begin with a small leaning. Not till the hamstrings have been lengthened by other exercises should the deeper leanings be attempted.

Lean position may also be taken from stoop position. The exercise is then called *stoop standing, trunk stretching forward.* The arms may hang loosely down (and then carried to yard position), or they may be held in wing, ear or stretch position In stoop position the hips are fully bent and the hamstrings fully extended. With the pelvis kept quite still and without any movement in the hip-joints the body is swung up to lean position by a stretching of the back. In trunk leaning from the vertical no movement takes place in the spine, the muscles of the back are working statically; here, on the other hand, there is a considerable movement of the dorsal and lumbar spine and the extensors are working concentrically in the upward movement and excentrically in the return.

Both forms are valuable.

Also *kneel stoop sitting, trunk stretching forward* is a good introductory exercise to the leanings, especially effective as regards the extensors in the dorsal region. In the kneel stoop sitting position the whole back is curved from the sacrum to

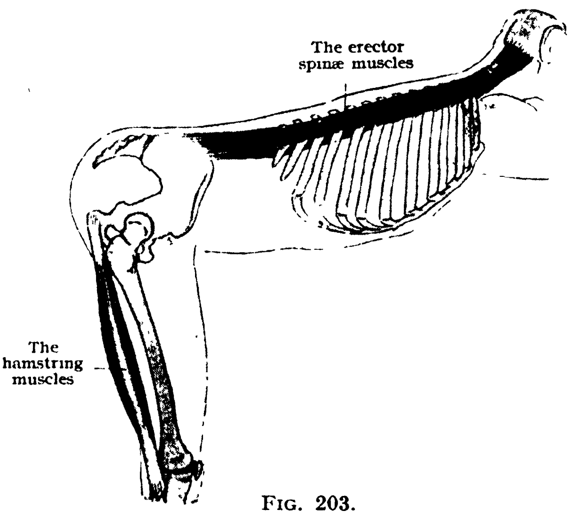


FIG. 203.

the neck. This curve is now straightened by an energetic contraction of the full length of the erector spinæ. The back will be straight and the trunk will be held almost horizontal. The dorsal part of the muscles in particular are working, because the greatest movement takes place in this region, which is bent forward very much in the starting position. For this reason this little exercise is very valuable. The arms may be held on the back or they may be carried sideways and the hands put on the floor during the bending and moved to yard position, a little higher than the shoulders, in the stretching. The command can be : *Stretch !—bend !* or it may be taken in time, the pupils counting, *Stretch !—bend !*

Muscle Work (Fig. 203). For the leaning forward in the hip-joints the *hamstring muscles* and the back part of *adductor magnus* work excentrically ; it is these muscles which stop the movement when they will not stretch further. *Gluteus maximus* works very little here. The task of this muscle is to produce movement in the hip-joint in walking, running and jumping ; in this exercise it hardly contracts. But to hold the trunk inclined forward during work is left to the hamstrings, which muscles, containing a great amount of tendinous tissue, are admirably fitted for work of this kind. The trunk and head are prevented by *erector spinæ* from falling downward with a bending in the spine.

2. In lean position various **Arm Movements** may be taken, *e.g., Arm stretchings sideways* and *upward* from bend position (pp. 172 and following), *Arm flingings* from yard or across bend position (pp. 186 and following), *Arm swinging forward-upward* from drag position (p. 190), *Arm swinging sideways-upward* from speech position (p. 191), *Arm swinging sideways* from low cross reach standing position (p. 188), *Arm raising sideways-upward* from speech position (p. 195), *Arm circling* (p. 192), *Arm circling in yard position*, and *Arm pressing backward* with jerks in stretch position.

These exercises are valuable both as dorsal and as arm exercises. Lean position greatly increases the work of the shoulder muscles during arm movements as already stated. Some of the arm movements in this position are therefore described under arm exercises (compare pp. 191 and following).

In arm stretchings and arm flingings sideways in lean position the fault of holding the arms too low in the yard position is more common here than when the exercises are done in the standing position(see pp. 172 and following).

In *yard stride lean standing, arm circling* the hands with the arms kept stretched describe small circles. The arms should here be carried well back, especially in the backward movement. The exercise soon feels tiring for the adductors of the shoulder-blades.

In *stretch stride lean standing, arm pressing backward* the arms are lowered forward slightly and jerked back with an energetic pull during which the trunk performs a counter-movement forward. Also here the adductors of the shoulder-blades have hard work to do, especially trapezius IIa, working fully shortened.

3. **Wing (Bend, Yard, Stretch) Walk Standing, Trunk Leaning Forward.** In walk position the trunk leans forward over the front leg while the pelvis is kept towards the front. Owing to the walk position the pelvis is apt to turn towards the rear leg, especially if the front foot is not turned sufficiently outward. If a turning takes place the movement forward will be partly a side bending, and neither of the movements will be carried out fully.

In walk position only the hamstrings of the front leg will be extended, but extended more forcibly than when the feet are in symmetrical positions, as it is easier to stretch one set of hamstrings at a time than two sets.

4. **Wing (Bend, Yard, Stretch) Oblique Twist Standing, Trunk Leaning Forward.** From oblique standing position the trunk is twisted so much towards the foot which has been moved that the chest is at right angles to the foot, and in this twist position trunk leaning forward is taken. Here also only one set of hamstrings is stretched at a time.

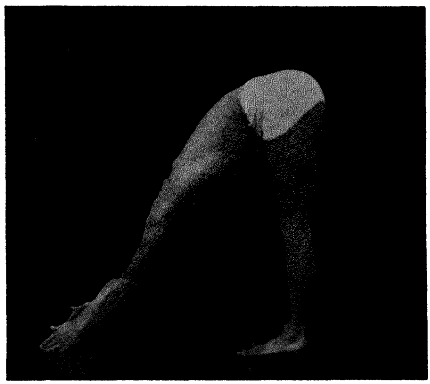


FIG. 204.

B. Trunk Bendings Downward

5. **Wing (Ear, Stretch) Stride Lean Standing, Trunk Bending Downward [Wing (Ear, Stretch) Stride Stoop Standing Position].** From lean position the teacher commands: *Downward—bend!* While the knees are kept fully stretched the trunk bends downward as far as possible, not only by the pull of gravity, but also by a strong contraction of the flexors of the hips and of the abdominal muscles which bend the loin; both sets of muscles are fully shortened.

The movement of the spine may be limited to the loin, in which case head and chest are held as in lean position (Fig. 204), or it may be extended to the whole spine so that also the dorsal spine is bent and the head carried as near to the knees as possible (Figs. 205 and 206).

Forward—stretch ! The trunk is moved to lean position without any movement in the hips. The stretching of the back begins from above, first the neck, then the dorsal region, and lastly the loin. This gives the dorsal erector spinæ greater work, and it is good practice in localising the work to the dorsal region and keeping the extensors of the hips out of it. These two sets of muscles work habitually together when in daily life we raise the body up from a stooping position ; it needs practice therefore to make them work separately. The knees must be kept fully stretched throughout the movement.

FIG. 205.

FIG. 206.

With trained pupils trunk leaning forward and bending downward can be taken in one movement on the command : *Right downward—bend ! Right upward—stretch !* Care must be taken that the trunk leaning is performed correctly as far as lean position before the bending begins and that a correct trunk stretching forward from stoop to lean position is taken before the raising upward begins.

It is worth mentioning that in a trunk bending downward the movement in the back takes place *from below upwards*, firstly the loin, then the dorsal spine, lastly the neck ; and in a trunk stretching upward *from above downwards*, firstly the neck, then the chest region, and lastly the loin. In contradistinction to this the movement in a trunk bending backward takes place from above downwards, neck, chest, loin ; and the return movement from below upwards, loin, chest, neck (see

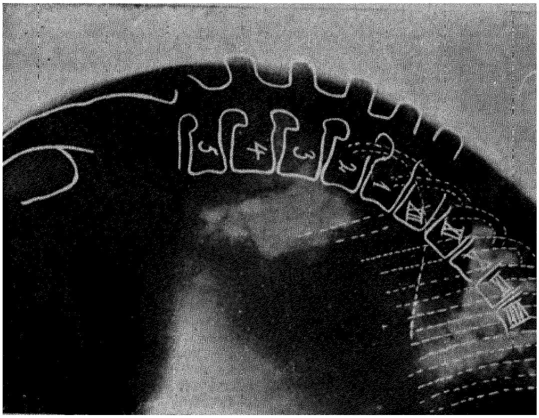


FIG. 207.[1]

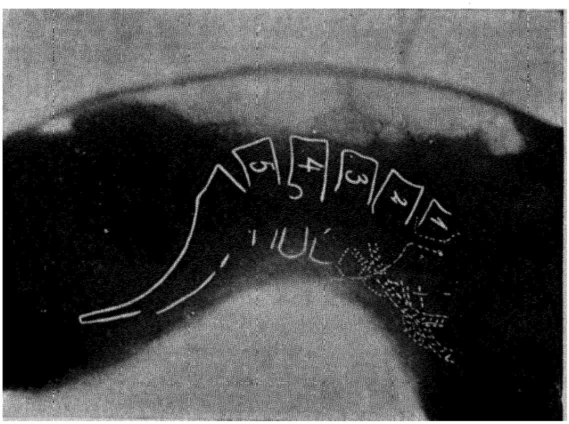


FIG. 208.[1]

[1] Fig. 207 is of the spine of the 13-year-old boy in Fig. 206 photographed in the position shown. He is not very mobile in the hips, which is easily seen when compared to the young man in Fig. 205. But his spine is very mobile, which the X-ray photos 207 and 208 (of the same boy) show. In the first picture the anterior parts of the intervertebral discs are compressed so much that the vertebral bodies almost meet; and the spinous processes are spread wide apart.

Fig. 208 is of the boy in a strong backward bending; he has bent sufficiently far back to place his hands on the floor fairly close behind the feet so that the body forms an arch. The anterior edges of the vertebral bodies are widely apart, whereas the posterior edges nearly meet, and so do the spinal processes. The discs are correspondingly pressed into wedge-shape.

pp. 282 and following). In daily life the order is the opposite.

Stride standing position provides the firmest starting position for a trunk bending downward, and it is easy to reach the floor, firstly, because the body can be lowered a little more in the lean position; secondly, because the trunk is nearer the floor when the legs are placed obliquely sideways than when they are vertical and kept together. Stride position ought therefore to be used first. But later *standing, close standing* and *walk standing* position should be used too.

The Importance of the Exercise and its Different Forms. The correct posture of the lumbar, as well as the dorsal spine, is necessary for a good carriage. The two sections of the spine must have normal mobility and well developed muscles of normal medium length.

The lumbar spine may be too curved, *hollow back*, or too straight, as in the *long round back* (pp. 110 and following). Both faults are accompanied by stiffness of the lumbar spine in a larger or smaller degree and an alteration of the normal length of its muscles. To do away with these faults we require exercises that make the loin supple and give its muscles their proper strength and length.

In *hollow back* the extensors of the lumbar region are too short and the spine is stiff as regards movement forward; in a backward direction it may be sufficiently flexible. The muscles in question are amongst the very strongest in the body, and considerable force is needed for extending them. The weight of the body when bent into stoop position is not enough, but the effect of a trunk bending downward may be increased, and this may be done, *e.g.*, in the following four ways:—

1. Firstly, the *arms* may assist. By grasping behind the ankles in stoop position and pulling with the arms the bending may be increased. The lumbar extensors will be stretched forcibly and the lumbar spine will be bent forward against its convexity (Fig. 205).

By standing with the back against the wall bars and pulling on one of the lower bars the effect will be even more pronounced.

If one places the feet wide apart and bends down with the head almost touching the floor (as in Fig. 209) there will be a marked extension of the adductors of the legs and a large bending of the hips, but the effect on the spine is not especially great.

A similar extension of the lumbar muscles and ligaments by the aid of the arms may also be had in the following exercises from other starting positions than standing :—

(*a*) *Grasp stoop long sitting, arm bending.* In the long sitting position one bends forward to stoop position, grasps the feet, and pulls the head down as far as possible towards the knees. May be taken in individual time or in joint-time. If done in joint-time the pupils can say : *bend !—rest !*

If the feet are placed against the bottom bar the pupils may grasp this or another low bar, and this firm grip makes a deep bending possible.

(*b*) *Angle lying, trunk bending forward, grasping the bar, and arm bending.* The pupils lie in angle lying position with the back of the legs against the wall bars, seat

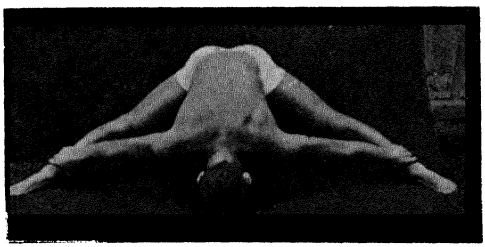


FIG. 209.

quite close to or a little distance from the wall bars. They bend forward, grasp a bar level with the ankles or the calves, and pull with their arms, rounding the loin forcibly.

(*c*) *Stoop hanging, arm bending, face towards the wall bars.* From reverse hanging position (body in the erect position but the head downward) the body is made to slide down between the arms till one is bent double in the stoop hanging position with straight legs. By a bending of the arms the head is pulled towards the knees.

2. Secondly, the legs may assist in the stretching of the lumbar extensor muscles.

(*a*) *Four-standing, knee stretching.* In four-standing position with the palms of the hands on the floor the weight of the body is partly shifted on to the hands, the knees are fully stretched, and the lumbar muscles are extended. The hands should be placed a longer or shorter distance from the feet according to the suppleness of the pupils (Fig. 210), and nearer to the feet as the suppleness increases (Fig. 211). If the hands leave the floor during the knee stretching the effect on the loin is much lessened.

The exercise is most effective when taken on a stool or a form where the pupils can grasp round the edges of the apparatus.

(*b*) *Grasp stoop crook sitting, knee stretching.* In crook sitting position (the knees only slightly bent) with the feet against the wall bars the pupils bend forward and grasp the lowest or one of the lowest bars. A knee stretching here bends the loin well forward. The knee stretching may be done in time, either alternately or both knees together. To avoid a sliding forward and backward on the floor the knees should be bent only slightly.

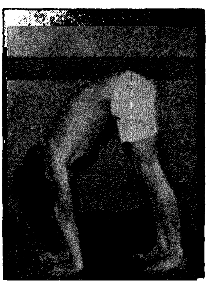


FIG. 210.

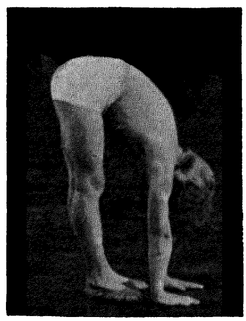


FIG. 211.

(*c*) *Stretch grasp stoop fixed back lying, knee stretching.* The pupils lie on their backs in stretch position, grasp the bottom bar (p. 306, Fig. 178), raise the legs, and place the feet under one of the lower bars with the knees slightly bent. Knee stretching as in (*b*) is now taken.

(*d*) *Stoop fixed crook hanging, knee stretching.* From hanging position the knees are raised and stretched upward or the legs are raised so high that the toes can be fixed under the bar the hands are grasping, knees are slightly bent. Also in this position the same knee stretchings as in (*b*) may be taken.

3. Thirdly, the lumbar muscles may be extended by swinging

the body rhythmically and thus making use of the bodily momentum.

(*a*) *Wing stride lean standing, trunk bending downward with free arm stretching to the floor.* Until the exercise is learned it is taken fairly slowly from wing stride lean standing position on the command: *The arms to the floor, trunk downward—bend!* The trunk is bent down as far as possible by a contraction of the flexors of the hips and the abdominal muscles; the arms are carried forward, hands touching the floor as far forward as they can so that the dorsal spine is bent as little as possible. *With hands on hips, forward—stretch!*

Afterwards the exercise is done in individual rhythm and later in joint-rhythm. The trunk is now bent downward in an energetic swing so as to increase the effect on the loin. The hands kept on the hips or beating against the floor well forward. The trunk is immediately swung back to lean position, which is held for a moment in order to give the extensors both of the dorsal and the lumbar spine an opportunity of contracting forcibly after their extension. The rhythm never so quick that the two positions, stoop and lean position, the latter especially, cannot be taken up correctly.

(*b*) *Drag stride lean standing, trunk bending downward with free arm stretching to the floor.* As (*a*), but the arms are carried from drag position straight forward and the hands touching the floor in the downward bending, and back to drag position in the stretching. The latter movement of the arms makes it easier to take up a good lean position. An outward rotation of the arms in drag position increases the adduction of the shoulder-blades.

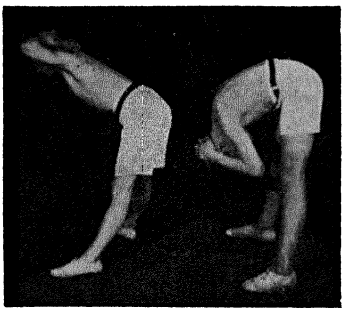
(*c*) *Ear stride lean standing, trunk bending downward.* As the body is swung downward from lean position the elbows are brought forward (Fig. 212, b), in the return movement they are again brought back to ear position proper (Fig. 212, a). This means dynamic work of the shoulder muscles which would have to work statically if the ordinary ear position were kept throughout. Head and elbows should be brought as close to the legs as possible during the downward swing or even in between the legs. Consequently the dorsal spine is bent as well as the lumbar.

Here also the lean position must be correctly taken after each swing, and occasionally a halt should be called so that the position may be controlled and corrected.

It is a very good rhythmical trunk bending and should be used often.

(*d*) *Stretch stride lean standing, trunk bending downward.* As (*b*), but the arms must be kept in stretch position the whole time; the hands beat the floor far forward so that principally the loin is bent.

This is the most powerful form of rhythmical trunk bending downward as the centre of gravity lies as high as it can because of the arm position. Before this exercise is taken the erector spinæ must be well trained by the use of exercises such as the foregoing ones. The person who is able to swing the body in correct form between stoop and lean position with the arms stretched upward has well developed dorsal extensors.



a FIG. 212. b

In order to make the erector spinæ, and especially the dorsal parts, work from the greatest extension to the greatest shortening the trunk bendings downward are often combined with a high trunk bending backward.

(*e*) *Stride standing, trunk bending downward with free arm stretching to the floor.* In the trunk bending downward, which is performed quickly and ends with an energetic jerk by contraction of the flexors of the hips and the abdominal muscles, the arms are carried forward, hands touching the floor well in front of the feet. In the return movement the arms are brought back to the erect position or to drag position.—If a trunk bending backward is added the exercise is more effective and feels more stimulating. The command is then: *Trunk bending downward and backward*—1—2 when taken by numbers; afterwards when done in time the executive work is: *begin!* During the bending backward the arms may be rotated outward to speech position (p. 191).

(*f*) *Yard stride standing, trunk bending downward with arm raising upward.* The arms are raised to stretch position during the trunk bending downward and lowered to yard position in the trunk bending backward with which the return movement ought to finish. Here also the trunk bending downward should end with an energetic pull. The rhythm for these large movements should be fairly slow otherwise the pupils will not carry them out fully.

(*g*) *Stretch stride standing, trunk bending downward, trunk stretching to lean position with arm swinging backward, trunk raising with arm swinging forward-upward.* The exercise is carried out in three movements on the command: *Quick trunk bending downward, raising through lean position with arm swinging backward and upward*—1—2—3. On 1 a quick trunk bending downward to which may be added a hard beat with the palms of the hands on the floor as this tends to make the movement more vigorous. On 2 trunk stretching to lean position with an arm swing backward. Care should be taken that the arm swinging backward does not pull the upper part of the trunk downward and round the back. The arm swinging should be checked by a slight stretching of the back so that the trunk is raised a little just at the moment when the arms would pull it downward. On 3 the arms are swung forward-upward and the trunk is raised at the same time. Here also the trunk should be pressed a little forward just at the end of the arm swinging to prevent the trunk being pulled backward by a bending of the loin (p. 190).

As soon as the exercise has been learned by numbers it should be practised rhythmically, to which it lends itself well. A beat on the floor with the hands is stimulating, but the teacher must take care that the time is not hurried, which means that the various movements cannot be carried out fully; especially the second movement, to lean position, should be done correctly each time.

(*h*) *Stretch stride standing, trunk bending downward.* Can be done in a *quick* movement downward and upward. The bending should begin in the hips, then in the loin, and lastly in the dorsal region; the stretching in the return movement in the opposite order, and one must try to get used to this order so that it is followed quite unconsciously.

(*i*) *Stretch stride standing, trunk bending downward and trunk bending backward with arm lowering to the side and arm raising sideways-upward.* The exercise is performed a little more slowly than (*h*) so that one has time to move the arms down past the legs in the stretching and sideways-upward during a high trunk bending backward, from there again a bending to stoop position with the arms in stretch position.

The exercises described under (*e*) to (*i*) may be combined with trunk twisting. The trunk is twisted to the left and is bent downward in a continuous movement; it is then raised into twist position, after that twisted round to the right and bent downward. The oblique muscles at the back (semispinalis) and the oblique abdominal muscles are thereby brought into play.

The momentum of the body may also be utilised in another way than by these great swings of the trunk, viz., in *small rhythmical movements* in the stoop position.

They are best taken in stride stoop position with the arms hanging down. If repeated often they lend themselves well to the stretching of short lumbar extensors. They should be interrupted fairly often by a trunk stretching forward to lean position so that the muscles of the loin may be trained in active contraction too and accustomed to normal medium length. One may, for instance, jerk the body 5 times in the stoop position and then take a trunk stretching to lean position which is held on an extra count. The pupils may count—1—2—3—4—5—*stretch ! stretch !*—and so on.

They may either endeavour to reach far forward in every jerk, or far forward in one jerk and far backward between the legs in the next.

The pupils may also swing the arms forward and backward on the outside of the legs in time with the jerks, the fingers sweeping the floor as the arms pass the legs.

Finally, they move the body first to one side, then to the other (*e.g.*, with the trunk twisted to the left 3 jerks downward towards the left foot, 3 jerks with the trunk turned forward and 3 jerks with the trunk twisted to the right foot); after each jerk the trunk is stretched forward to the lean position. The arms may assist by grasping the ankles and pulling (see p. 340, but quicker time).

4. The fourth way in which the effect on the lumbar extensors of exercises in stoop position may be accentuated is the using of a *helper*. When a pupil sits in stoop long sitting position his partner can stand behind, place his hands on the shoulders of the one sitting, and by even pressure to a suitable rhythm increase the bending forward. The pressure should not be too violent so as to call forth active resistance from the pupil sitting as in that case the exercise defies its purpose. It should only be taken with pupils who understand the use of the exercise and as a rule only with adults.

The trunk bendings mentioned affect not only the loin and its muscles but also the hip-joints and the hamstrings. And it is difficult to keep the effects in these two regions separate. The hamstrings may be stretched, however, without any effect on the loin by little jerky movements in the lean position; correspondingly the loin may be affected by itself when the trunk bendings are done with bent knees, as for instance in crook sitting, trunk bending forward. In order to make this exercise at all effective one must grasp below the knees and pull with the arms or grasp a wall bar when one is sitting with the feet against the bars.

But the strongest effect is obtained in the exercises that affect both regions together, and these exercises are far the more numerous.

And nowadays (1936) they are used most diligently. For each full contraction of the dorsal extensors and the hamstrings the same muscles are fully extended perhaps a hundred times, and the effect seems greater on the hamstrings than on the back muscles. If we continue like this the result will be very long hamstrings, a doubtful advantage. Young people trained by hard bodily work are probably able to suffer a vigorous extension of these muscles without any harm accruing. But in the case of children with immature and yielding tissues it is a different matter. In them abnormal mobility may be developed, and this must be avoided. The loin may become too flexible and the dorsal extensors too long so that gymnastics, instead of counteracting, has produced a poor working position, whether sitting or standing, with rounded back and prominent loin.

With all pupils, first and foremost with growing children, at least as much stress should be laid on the strengthening and the shortening of the extensors of the back as on their stretching. Consequently bendings downward must be accompanied by a corresponding number of stretchings, *i.e.*, high trunk bendings backward. The dorsal extensors, like other muscles, should be used from the greatest lengthening to the greatest shortening to secure their full development and their proper medium length.

It is natural that pupils suffering from hollow back would benefit from exercises bending the loin against its convexity, but what about those that do not suffer from hollow back, or who even suffer from the long round back with too slight lumbar curve and too long dorsal extensors ? And one must not forget that it is difficult to individualise in the gymnasium. One answer to this is that minor degrees of bad posture (the first degrees of scoliosis as well) may be corrected or at least be improved by sensible all-round gymnastics. And as the spine in long round back is stiff as regards bending forward as well as backwards, bendings forward-downward in such cases are necessary, although the stretchings or bendings backward naturally are of greater importance.

Trunk bendings, especially when done rhythmically, are enjoyable and stimulating exercises ; a great part of the body is moved so it does not take long before one is warmed up. That must be the reason for their popularity. They are not showy exercises and they do not make for dexterity, but the suppleness of hips and loin which they provide is of course attractive. If one secures active contraction of the dorsal muscles corresponding to the extension of the same muscles there is no risk of misuse ; it is against the one-sided use of these excellent exercises one must express a warning.

Common Faults. (*a*) The knees are bent during the trunk bending which means less extension of the hamstrings.

(*b*) During the trunk stretching forward the hip-joints are not kept fully flexed but the pelvis is raised slightly, then the stretching does not take place from above downwards.

(*c*) The head is bent too far backward during the trunk stretching.

(*d*) In yard position the arms are below shoulder level ; in stretch position they fall forward.

Muscle Work. In lean standing, trunk bending downward, gravity pulls the trunk downward with bending in the spine (especially in the loin), while the *erector spinæ* yield, and thus work excentrically. The weight of the upper part of the trunk is not able to stretch the very strong extensors especially in the loin as much as they can be stretched. The last part of a trunk bending—that which is most effective—is done, therefore, by an active work of the *abdominal muscles* working in a very much shortened condition. These muscles, however, pull upward in the pelvic rim with the same force as downward in the ribs, and consequently the flexors of the hips will have to fix the pelvis by pulling it downward, and the bending of the hips is a little increased ; this is the reason why a trunk bending downward can give stronger stretchings of the hamstrings than a trunk leaning forward, although the trunk has a greater leverage in trunk leaning forward than in trunk bending downward.

The strong tension on the hamstrings does not bend the knee as one would think, because in the full knee stretching there is an inward rotation of the femur at the last moment, and by this inward rotation the knee is locked and cannot be bent till it is unlocked by a corresponding outward rotation. As soon as this outward rotation has taken place and the knee flexion begins the extensors of the knee must act. This is easily felt as the loose knee cap is fixed and the slack patellar ligament is tightened.

This locking of the knee relieves the extensors, as *e.g.*, in a position of ease where one shifts the weight on to one leg which is kept fully stretched.

The insertions of the hamstring muscles on the side of tibia (semimembranosus and semitendinosus) and on the head of fibula (biceps femoris) also help to explain why the hamstrings do not bend the knees during trunk bending with fully stretched knees. The insertions of these muscles are brought so near to the axis (through the middle of the knee joint) that their leverage is almost *nil.* If the knees are hyperextended the insertions may even lie in front of the axis so that the hamstrings will now stretch the knees. Hyperextension means a weakening of the knees. Trunk bending downward should therefore not be practised to such an extent that this may be produced.

People with partly or completely paralysed knee extensors fling the leg down in walking so that the knee may be overstretched because in that case they are able to support themselves on the leg. Here hyperextension will soon be developed so that the flexors of the knee come to act as extensors when the leg is stretched.

C. Front Lyings

6. Wing Fixed Front Lying, Trunk Bending Backward (Wing Arch Front Lying Position). Stools, form, beam, floor (grass-field).

The pupils fall in at the wall bars and when the stools are placed at the proper distance the teacher commands: *Front lying—place!* All quickly lie down over the stools so that they are resting on their thighs with the knees and lower part of the trunk free; the feet are fixed by being put in between two bars at the height of the stool; the heels are outside the bars. The hands rest on the ground.

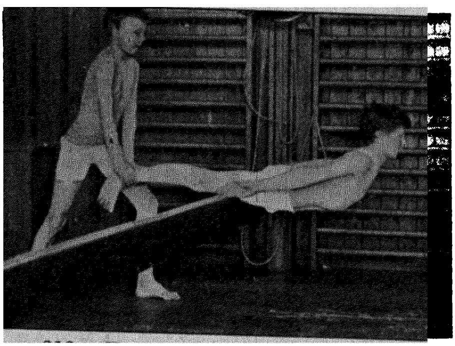


FIG. 213.—Front lying on balance beam above knee height.

With hand placing on hips, trunk backward—bend! While the hands are quietly taken from the ground and put on the hips, the trunk is bent slowly backward; the head is raised a little with the chin in; the chest is pushed well forward, so that the dorsal part of the spine is bent as strongly as possible. The knees are kept fully stretched.

(*On the*) *hands—support!* The trunk is lowered slowly and the hands put on the ground.

From position—up! The erect position is taken quickly.

If benches are used, they are placed at a suitable distance from the wall bars before the pupils are arranged there.

Support for the feet can also be given by a partner (living support). The pupils then stand in rank arrangement at a row of benches or stools, or at a low beam. "Twos" stand behind "ones"; the latter, because of putting hands on hips, must be at least half a step's distance from each other. The teacher then commands: "*Ones,*" *front lying—place!* "*Twos*"—*support!* "Twos" kneel on a knee which is indicated beforehand, put the other foot well forward beside the legs of the partner, and support by placing the hands on the ankles just above the heels. To make the support firm the "twos" must lean forward so that their shoulders are over the heels of the "ones" and their arms vertical. The heels must not be pressed down below the height of the apparatus. Lunge-forward standing and lean stride standing can also be used as supporting positions, especially when the apparatus is high (Fig. 213). For the changing place of "ones" and "twos" see p. 135).

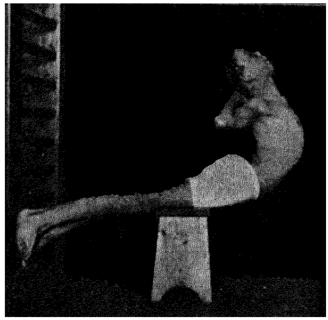


FIG. 214.

A quick head turning can be added to this exercise on the command: ***Quick head turning*—1—2—3—4.**

One must make it clear to the pupils that they should not strive to raise the trunk high up. If the feet are fixed too low some are able to raise the body almost into vertical position (Figs. 214 and 215). But the higher it is raised the less work for the extensors of the back and the hips. It is the work of the extensors in the dorsal region that is

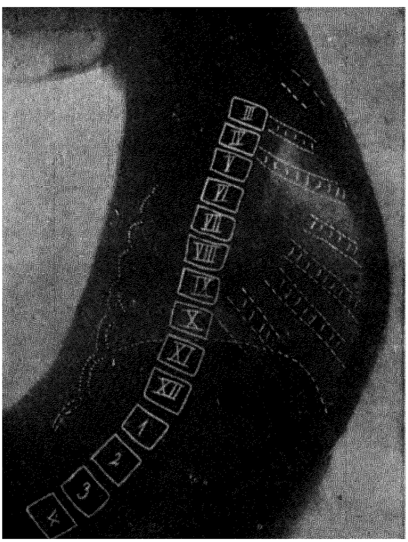


FIG. 215.—The supple 13-year-old boy in Fig. 214 X-rayed in the position. The dorsal spine has kept a slight convexity in a backward direction, indicating that the upper dorsal extensors are not working very hard in this position with the upper trunk vertical.

especially lessened, and it is these muscles above all one wishes to train. It is therefore important to fix the feet sufficiently high when the exercise is performed on stool, form, or beam. It will also be understood that the exercise may be done very effectively on the floor. When lying on the floor with the feet fixed under the bottom bar or held by a partner the loin cannot be bent as much as, for instance, in a standing, trunk bending backward. Few people are able to lift the trunk very high off the floor and the extensors of the dorsal region now have to carry head, arms, and shoulders in a position in which the weight of these parts of the body has a long lever to work on. If the feet are fixed sufficiently high when the exercise is taken on stools, etc., the same good effect is obtained as when done on the floor.

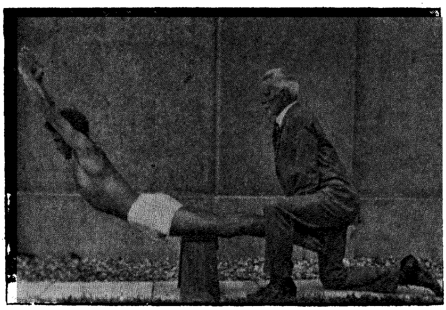


FIG. 216.

The exercise may also be taken, especially with younger children, in free front lying position on the floor (feet not fixed). Both trunk and legs are then lifted from the floor if the bending backward is fairly great. If the bending is only slight, however, the legs remain on the floor, one rests on the whole front up to the edge of the ribs, and there is only a stretching of the dorsal spine without a bending of the loin worth mentioning.

Front lying trunk bending backward in free lying position should be used a great deal, especially for children (see pp. 367 and following). It requires no apparatus and consequently takes no more time than a free standing exercise. The exercise has only this disadvantage, that origin and insertion of erector spinæ are not fixed, consequently these muscles cannot work as vigorously as when the lower attachment is fixed, which it is when the feet are fixed.

Fixed front lying trunk bending backward, like standing bendings backward (see p. 282), should be taken *from above downwards.* The dorsal muscles will not work fully if they are not put into action at the very beginning of the movement. If the bending takes place in the loin first it easily becomes so great that the abdominal muscles and the linea alba cannot be stretched any more and consequently a subsequent straightening of the dorsal spine will be out of the question.

It should therefore begin as a ***high trunk bending backwards*** (***i.e.***, stretching of the dorsal spine, see p. 288) during an energetic contraction of the extensors in the dorsal region. This last exercise is valuable not only as an introductory exercise but as an exercise by itself, and it should be used often in order to keep the dorsal spine mobile and give better control of its muscles. But naturally, it must not entirely take the place of ordinary front lying, trunk bending backward with its marked effect on the mobility of the entire spine and the strengthening of all the extensors of the back.

Front fixed lying, trunk bending backward may be made more difficult by various arm positions and movements. The most important forms are: *drag*, *speech*, *bend*, *across bend*, *yard*, *ear*, and *stretch fixed front lying, trunk bending backward*.

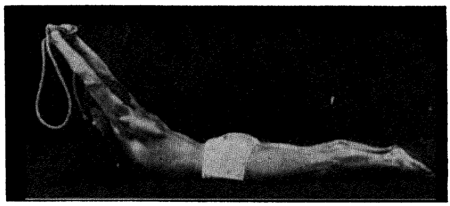


FIG. 217.

The most important arm movements are: from drag position *arm raising sideways-upward* or *forward-upward*; from speech position *arm raising sideways-upward*; from bend position *arm stretching sideways* or *upward*; from across bend position *arm flinging sideways*; from yard position *arm raising upward*; from stretch position *arm lowering sideways*. By holding a stick or a folded skipping rope in both hands the effect both as regards suppleness and strength of the shoulder muscles may be increased. As suppleness increases, the hands may be brought closer together as far as shoulder-width (Fig. 217).

Common Faults. (*a*) The loin is bent too much.

(*b*) The head is not pressed sufficiently back, and the chin is poked forward.

(*c*) In arm stretching sideways the arms are lowered below shoulder height.

(*d*) In arm stretching upward the arms are not fully stretched, they are not pressed far enough back, and the head falls forward.

7. Wing (Bend, Ear, Stretch) Fixed Arch Front Lying, Trunk Leaning (Trunk Bending) Forward. The starting position is taken as given in 6 ; the position on the floor cannot be used.

Trunk forward—lean ! The leaning must as usual take place in the hip-joints ; the pupils should try to maintain the backward bending of the trunk. If the arms are in the stretch position they are laid along the ground and the chest is pressed downward in order to stretch the pectorals (Fig. 218).

Trunk bending forward may also be taken, best with the arms in ear position. The trunk is bent forward till the forehead touches the floor and then back to arch position. The back muscles are working statically in a trunk leaning but here excentrically and concentrically. In ear position the hands

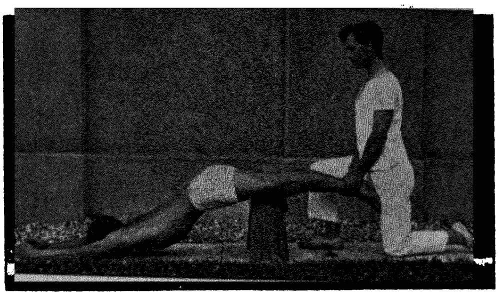


FIG. 218.

press on the head and in that way give the cervical extensors more work to do.—Hardy pupils should use the flat edge of the beam as this enables them to perform large movements both in the back and in the hip joints.

The exercise should preferably be taken rhythmically, first in individual rhythm, later in joint-rhythm. In this form it is a very effective dorsal exercise.

In the front lying position on apparatus *trunk twistings* and *side bendings* may also be taken.

In trunk *twistings* the arms should be flung alternately sideways, if possible, to the vertical from the across bend position. The feet fixed apart make the position still firmer.

For *side bendings*, carried out fully in slow time, the best arm positions are erect, bend, and ear position. Here also the feet apart.

In the front lying position the nearer the sacrum the more fixed the vertebræ are as the lower erector spinæ, having the greater weight to carry, are more tense than the upper ones. In standing trunk twistings and side bendings the loin takes part in the movements readily, the dorsal spine less readily; here the opposite is the case. For that reason one should not forget to practise trunk twistings and side bendings in this position.

Muscle Work and the Importance of Front Lyings. Simple as these exercises are their muscle work is equally simple, as shown by Fig. 219. The trunk is bent backward by a movement of the whole spine during strong contraction of all the *erector spinæ* from the sacrum to the back of the head. They are acting concentrically and the adductors of the shoulder-blades,

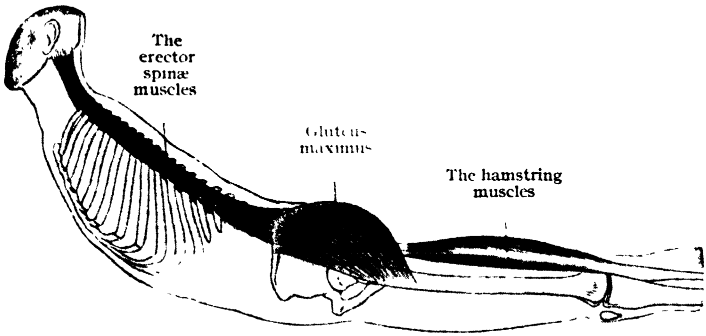


FIG. 219.

trapezius and *rhomboid*, are acting with them as it were automatically. The hip-joints are kept extended especially by *gluteus maximus* and the *hamstrings*. In the free front lying position the hamstrings will bend the knees during a trunk bending backward; they must therefore be kept straight by the quadriceps extensor.

In a trunk leaning forward the extensors of the back are working statically and the hamstrings lower the body by giving, *i.e.*, working excentrically, whereas they work concentrically in the return movement.

In a trunk bending forward and downward the movement takes place in the spine and the hips. The extensors work first excentrically, then concentrically.

Front lyings are the most powerful dorsal exercises involving the greatest shortening of the erector spinæ, especially the dorsal parts. They form an excellent supplement to the many different trunk bendings downward in which the dorsal muscles are fully extended. They shorten the dorsal muscles more than trunk stretching from stoop to lean opsition which, as mentioned on pp. 336 and following, is also a valuable compensating exercise to trunk bending downward.

The extensors are not working as hard in lean position as in front lying, as some teachers seem to think. Experience will soon tell one that the latter is far more tiring. Lean position may be compared to fixed arch front lying with the feet fixed too low, lessening the difficulty of the exercise. The pelvis cannot get into the same position with the sacrum horizontal in lean position as in front lying with horizontal legs; hence the difference of exertion.

That the dorsal extensors are strong originally, infants bear witness to. Front lying exercises are performed with greater ease by them than by most adults. Many adults past their first youth can only keep the front lying position by a great effort; this holds good particularly as regards women and mostly those whose garments have been too tight round the waist causing poor development of the extensors and stiffness of the spine. If a young girl has slack dorsal muscles, feels tired, perhaps even suffers from backache in the sitting position, no single exercise is better for her than front lying (provided the backache has not other and more serious causes). A front lying exercise taken regularly every morning just after rising would soon strengthen the dorsal muscles and do away with fatigue and backache, and a good posture throughout life might be secured.

If a *scoliosis* is developing front lying is also an excellent corrective and curative exercise. In scoliosis the erector spinæ on the one side are stronger than on the other. In front lyings the muscles of both sides are working together and doing equal work, and yet the exercises have a corrective effect. Most likely the weaker muscles are stimulated more than the stronger ones and so develop and gain on the others.

It should be mentioned that the *breathing* is free and unhindered during front lying as the ribs can move comparatively freely. The ribs are lifted considerably in the position, and yet spirometer tests show that exhalation is almost as deep in this as in a standing bending forward of the trunk with the accompanying lowering of the ribs.[1]

If one exhales deeply with the back fixed in a stretched position or in an arched position as in front lyings the ribs are lowered as much as they can only by movements in the joints between spine and ribs. The mobility here is therefore increased. When the ribs are lowered by a trunk bending forward, their joints are not fully moved and their mobility is not enlarged.

As said before, front lying and other dorsal exercises do not hinder breathing, at least only in a small degree. Quite the opposite is the case in abdominal exercises as here the abdominal muscles pull on the ribs and hinder their movements and by their pressure on the abdominal viscera hinder the lowering of the diaphragm too.

When breathing goes freely during walking and running the explanation is the same as in the case of dorsal exercises. The body leans forward and is carried by the extensors. The same takes place during most of our work. Strong dorsal extensors enable one to carry the trunk in the many positions inclined forward during work and thereby they increase one's endurance considerably.

In this connection it must be clear that it is irrational to base physical development on exercises requiring a fixed thorax in order that the muscles arising from it (the pectoral and the abdominal muscles) may have a firm attachment during their work. But one does so when the main stress is put on exercises in horizontal and parallel bars (see p. 230).

Front lying is that posture exercise one can use the longest in life. The baby may do front lying from its first or second month (p. 83). In the front lying position it trains the muscles lifting the heavy head, the erector spinæ from the middle region of the dorsal spine to the back of the head. And just these muscles are the most important as regards good posture because it is they that give the head, the neck, the upper dorsal column, and the upper ribs, the correct carriage, and build the bust harmoniously. Little children like lying on the front, and they go on with it as they grow older. They are,

[1] A man with mobile ribs could exhale 5,4 l air in standing position with trunk bending forward, and 5,2 l in arch front lying position on floor, keeping the latter position during inhalation as well as during exhalation.

for instance, fond of lying on the front while reading. Their instinct tells them that the position is good for their bodily development. At school front lying is one of the exercises they most easily learn. If a child has fixed its feet in the proper position the front lying exercise will be done correctly at the first attempt. The child is hardly able to make mistakes. If one kept up this exercise during advancing years one would find it an excellent means of preserving good posture, mobility, and elasticity, and of combating the effects of old age.

D. Lungings Forward and Outward as Dorsal Exercises

Lungings forward and outward are leg exercises and as such described on pp. 147 and following; but as they involve a forward inclination of the trunk and bending and twisting they are also trunk exercises, partly lateral (p. 270), and partly dorsal exercises. The demarcation between the two groups, lungings as leg and as trunk exercises, is—somewhat arbitrarily—determined by the position of the arms. Lungings with the arms in wing position are considered leg exercises; when the arms are placed higher they are called trunk exercises. It should, however, be remembered that the higher positions of the arms increase the muscular work not only as regards the trunk but also as regards the legs.

8. **Lungings Outward.** (*a*) *Bend twist lunge-outward standing, arm stretching sideways (upward).*

(*b*) *Yard (across bend) twist lunge-outward standing, arm flinging.*

(*c*) *Drag twist lunge-outward standing, arm swinging sideways-upward (forward-upward).*

(*d*) *Drag twist lunge-outward standing, trunk bending downward carrying the arms to the floor.*

(*e*) *Stretch twist lunge-outward standing, trunk bending downward.*

(*f*) *Standing toe placing obliquely forward, trunk twisting and arm raising sideways-upward, from there lunging outward with arm swinging forward-downward-sideways. Returning the same way.*

When lunge-outward position to the left has been taken (see pp. 147 and following) the teacher commands: *Trunk to the left—twist!* The trunk is twisted till the chest is facing the direction in which the left foot is pointing. After some practice the lunging and the twisting may be done simultaneously.—The starting position may also be reached by a toe placing obliquely forward together with a twisting and then a lunging. This provides fine plastic movements. There are many good combinations of which (*f*) is an example.

Care should be taken that the arms in yard position are held a little above shoulder level. Even a slight lowering below that level diminishes the good effect of the exercise considerably (pp. 172 and following).

In trunk bending downward one is apt to stretch the front knee a little as this makes the exercise easier. One should, on the contrary, endeavour to bend the knee further during the trunk bending.

9. **Lungings Forward.** (*a*) *Bend front lunge standing, arm stretching sideways (upward).*

(*b*) *Yard (across bend) front lunge standing, arm flinging.*

(*c*) *Drag front lunge standing, arm swinging sideways-upward (forward-upward).*

(*d*) *Drag front lunge standing, trunk bending downward carrying the arms to the floor.*

(*e*) *Stretch front lunge standing, trunk bending downward.*

Lunging forward is described on pp. 150 and following, otherwise as in 8.

10. **Toe Lunging Backward.** (*a*) *Bend toe lunge backward standing, arm stretching sideways (upward).*

(*b*) *Yard (across bend) toe lunge backward standing, arm flinging.*

(*c*) *Drag toe lunge backward standing, arm swinging sideways-upward (forward-upward).*

(*d*) *Drag toe lunge backward standing, trunk bending downward carrying the arms to the floor.*

(*e*) *Stretch toe lunge backward standing, trunk bending downward (Fig. 220).*

(*f*) *Run standing, toe lunging backward with arm raising sideways-upward (forward-upward).*

(*g*) *Stretch run standing, toe lunging backward with arm lowering sideways to yard position.*

(*h*) *Stretch run standing, toe lunging backward with arm swinging forward-downward-sideways.*

(*i*) *Yard run standing, toe lunging backward with arm swinging downward-forward-upward.*

Toe lunging backward is described on pp. 150 and following, otherwise as in 8.

11. **Fixed Standing, Forward Lunging.** Wall bars. (*a*) *Wing fixed standing, lunging forward.*

Back against, to the wall bars—run! A short step forward—march! (At knee level) left foot in the bars—fix!

The left foot is fixed between two bars at knee level; the foot hooked round the lower one, the heel pressed against the upper bar providing a firm grip; the knees together.

Hand placing on hips, with a lunge right foot forward—place! Left foot pushes off vigorously so that the right foot is carried forward in one hop so far that the left knee is stretched.

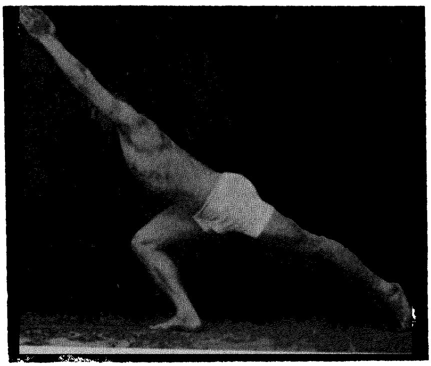


FIG. 220.

Right foot is placed down turned outward as in the erect position; the knee, bent to right angles or less, carried well outward so that it is above the toes. The trunk leans forward in line with the rear leg but with the head and the upper trunk somewhat raised with the legs forming an even arch; the abdomen if possible touching the thigh (Fig. 221).

The changing may be done in two ways, either by carrying the rear foot forward or by hopping backward on the front foot. In the former case the teacher may command, *Rear foot forward, foot changing*—1—2—3—4. On 1 the left foot is moved forward to the right foot and the body is raised; on 2 a step backward; on 3 right foot is fixed in the bars; and on 4 lunging with the left foot is taken.

In the latter case the command is: *With a hop backward, foot changing*—1—2—3—4. On 1 right foot is brought back with a hop, knees now together, and the body is raised ; on 2 left foot is placed down beside the right ; on 3 right foot is fixed ; on 4 lunging with the left foot.

The erect position may also be taken in two ways, either by carrying the rear foot forward (*Rear foot forward, stand—erect !*) or by a hop backward on the front foot (*Front foot backward—place ! Stand—erect !*).

The exercise is best taken at the wall bars but may be done at a beam at knee level. The foot is placed across the beam on the command : *Left foot on the beam—support !*

Finally, living support may be used. No. "ones" stand two steps in front of No. "twos". The teacher commands : *No. "ones" left toe lunge backward, No. "twos" support—place !* No. "ones" lunge backward with the foot at knee level. Simultaneously No. "twos" moving the left leg, lunge backward with a half turn, grasp their partner's leg, left hand on the instep, right hand round the lower leg, press the foot firmly against the inner side of the thigh on which the right forearm rests. The changing is taken on the command : *Changing*—1—2. On 1 all stand erect ; on 2 the exercise is repeated with the other foot.

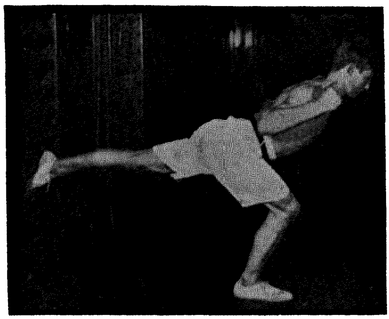


Fig. 221.

Faults as p. 151, (*e*) to (*h*), in addition :

(*a*) Rear leg bent.

(*b*) Rear foot not gripping the bar firmly and turned inward.

(*b*) *Bend fixed front lunge standing, arm stretching sideways* (*upward*).

(*c*) *Yard* (*across bend*) *fixed front lunge standing, arm flinging.*

No. "ones" and "twos" alternately bend the front knee further than usual so as to make room for the arms in the arm flinging.

(*d*) *Drag fixed front lunge standing, arm swinging sideways-upward* (*forward—upward*).

(*e*) *Drag fixed front lunge standing, trunk bending downward carrying the arms to the floor.*

(*f*) *Stretch fixed front lunge standing, trunk bending downward.*

In (*e*) and (*f*) the knee is to be bent still further.

The lungings described in 8 to 11 are not used much nowadays. For one thing they are difficult, hardly suitable except for trained gymnasts who have an understanding of plastic form in positions, an understanding which these exercises are able to develop.

Further, they are tiring as each separate movement is taken to a separate command ("static gymnastics").

If they are to come into common use again, which they deserve, they must be done rhythmically.

a FIG. 222. b

Besides their plastic value they are also of value as leg exercises. As stated on p. 159 knee bendings are amongst the best leg exercises, and lungings provide a needed variation. Lungings are powerful leg exercises because one knee at a time is bent while carrying a great part of the weight of the body. They are able to develop the muscles in question, and they are attractive both because of their form and, when taken rhythmically, because of their rhythm.

E. Game-like Exercises

12. **Cross Sitting Trunk Bendings Downward and Trunk Stretching.** (*a*) *The Balloon.* On: *bend!* the little children collapse forward till the forehead touches the floor, if possible. On: *stretch!* they raise the body up to vertical position and stretch themselves well (Fig. 222, b).

The children are supposed to be balloons that collapse and afterwards are inflated. A deep exhalation and inhalation help them to perform the movements properly and effectively and to find the proper time when the exercise is done in time. The children may count aloud: *bend!—stretch!*

(*b*) *Cross sitting, trunk bending forward and trunk stretching* *with hand beating.* Slightly older children may stretch the arms far forward during the bending and mark the time by beating the hands against the floor. During the stretching they beat the hands against the floor beside the hips. These hand beatings mark the end of the two separate movements too and they encourage the children to carry out both movements fully.

(*c*) *Cross sitting, trunk bending forward and trunk stretching with arm raising sideways.* This exercise like (*b*) is for slightly older children. During the bending the arms are carried forward and stretched along the floor; during the stretching they are raised sideways to yard or flight position, and this arm raising tends to accentuate the stretching of the back, the main point of the exercise.

13. **Kneel Stoop Sitting, Trunk Stretching to Kneeling Position (Jack in the Box).** From kneel sitting, on the command: *bend!* the children bend forward till their foreheads touch the floor, making themselves as small as possible. On a given signal (a blast on the whistle or *now!* from the teacher) they rise suddenly up on their knees to kneeling position and stretch their arms upward or obliquely sideways-upward to flight position, after which they bend down again (Jack is now pressed back into the box).

14. **Kneel Stoop Sitting, Trunk Stretching to Kneel Lean Sitting Position.** From kneel sitting position the children, on the word: *bend!* move forward till their foreheads touch the floor. On: *stretch!* they raise the body to kneel lean sitting position, *i.e.*, in kneel sitting the body inclined forward as near the horizontal as possible, back straight. Very soon the exercise may be done rhythmically in fairly slow time. Now and then a halt is called in the lean position in order that the position may be controlled and corrected. To secure a good position a head bending forward and a head pressing backward may be taken till the back of the head and the neck are in line with the back. To the trunk stretching an arm raising sideways, later sideways-upward, may be added.

15. **Crook Stoop Sitting, Trunk Stretching Upward (with a High Trunk Bending Backward).** In the crook sitting position with the hands on the knees the children bend well forward on the command: *bend!* On: *stretch!* they straighten their backs by an energetic and yet not too quick stretching (Fig. 222, a). When learned it may be taken rhythmically, the children counting: *bend!—stretch!*

After sufficient practice the stretching may be carried so far as to become a high trunk bending backward. Now and then the children stop in the arched position and by little pulling movements with the head and neck endeavour to increase the stretching of the dorsal spine and to train the dorsal extensors (see pp. 287 and following). In this way an element of dynamic gymnastics has been added to the arch position.

16. **Stretch Kneeling, Hand Beating on the Floor.** When the children are in the stretch kneeling position the teacher commands, for instance : *Beating the floor*—1. The hands beat the floor with a quick trunk bending downward ; without a pause the trunk is raised quickly up again with the arms in the stretch position.

17. **Stretch Kneeling, Trunk Leaning Forward ("Greeting like Japanese").** From the stretch kneeling position is commanded: *Trunk leaning* (or *bending*) *forward*—1 2. On 1 the trunk is inclined forward with a bending in the knee and hip joints, so that the seat is halfway towards the heels ; the hands and forearms are put on the ground ; the chest is pressed down towards the floor (Fig. 223), so that the upper part of the trunk and the arms are about in the same position as in trunk leaning forward from stretch arch front lying position. (Fig. 218).

FIG. 223.

In this position the children may beat the hands against the floor one at a time by raising the arms slightly off the floor alternately.

18. **Stride Standing, Quick Trunk Bending Downward with a Light Touch on the Heels and Quick Raising with a Light Beat on the Side of the Legs.** The children, with the knees kept straight if possible, bend down quickly with a light tap on their heels ; then raise themselves quickly with a light beat on the side of the legs. In their effort to touch the heels they bend deeply, and the beats help them to keep time and stimulate them to greater effort. The children may count 1—*and*—2—*and*—1—*and*—2. The exercise may also be done with the arms in yard position. After each beat on the legs

the arms swing quickly to yard position before the bending downward. Here they may count 1—*and*—2—*and*—3—*and*—1, and so on.

19. **Stretch Stride Standing, "Chopping."** The teacher commands: *Chopping—go!* With the knees fully stretched the children bend the body forward-downward, swing the arms backwards, fingers sweeping the floor, arms outside the legs. The arms immediately return, the fingers again sweeping the floor, and, as it were, raise the trunk upward so that the movement finishes in a good stretch stride standing position. In the stoop positions the body swings a little up and down by movements in the hips so that the body is in the deepest stoop position each time the fingers sweep along the floor.

20. **Stretch Stride Standing, Trunk Bending Downward Quickly with Hand Beating on the Floor.** The command can be: *Beating the floor*—1 (or *Go!*). The trunk is bent quickly down and the hands beaten on the floor; without a pause the trunk is quickly swung back to stretch position, preferably with a slight head bending backward in the final position. To begin with the children must be allowed to bend the knees slightly. The exercise should first be taken by numbers, later in time, but fairly slow time so that the movements may be carried out fully.

21. **Stride Standing, Trunk Bending Downward with Trunk Twisting.** The teacher commands: *Quick trunk bending downward with trunk twisting*—1—2—3—4. On 1 the trunk is twisted and bent downward over the left foot, the right hand clenched placed on the floor beside the left foot. On 2 the body is raised. On 3 and 4 corresponding movements to the right. When taken in time the children may count. *Left—and—right—and*, and so on.

22. **Stride Lean Standing, Trunk Twisting with Alternate Arm Punching towards the Floor ("Kneading Dough").** From the stride lean standing position with hanging arms the children twist the trunk to the right and punch the clenched left hand towards the floor, right arm is at the same time drawn up to across bend position. The body now twists to the left so that the position is reversed. And this "kneading" is now continued in time. As the arm is thrust downward the hips give a little so that the body comes to swing slightly up and down while the back is kept absolutely straight ("Our baker does not round his back while kneading dough.").

23. **Front Lying Exercises on the Floor.** As mentioned on

p. 354, front lyings should be used extensively, especially with little children. But these simple exercises must be varied so as to avoid monotony. Not only by varying the exercises but also by appealing in different ways to the children's imagination may the teacher avoid monotony. In the following a few examples are given.

(*a*) **"Keeping a Look Out."** The children lie on their front resting the head on their hands. The teacher says: *Look out!* and the children lift the head well up, shading their eyes with both hands. They do not look straight forward only but also to the left and right, yes even backward, and in that way twist and bend the body. Then they lie down again for a rest.

Ordinary trunk bending backward may also be taken to regular command, and by adding an arm twisting or rotation outward the effect on the shoulders will increase (Fig. 224). The teacher may also add head turnings and head bending forward with a marked drawing in of the chin in order to train the children in a good carriage of the head. A few words as to the good effect of the exercise will easily interest the children.

FIG. 224.

(*b*) **"The Snail."** Lying on their front, the children lift their heads and stretch their arms half way or fully upwards. They play at snails. The arms are the horns put out by the snail and they bend or twist the body like a snail.

(*c*) **"Rifle Fire and Gun Fire."** The children are in stretch front lying position resting on the floor. On the command: *Fire!* they lift the arms off the floor and beat the hands alternately and quickly against the floor so as to imitate rifle fire. On: *Halt!* they put their arms down and rest.

If they are "firing guns" they lie with the arms raised well off the floor and on: *Now!* they all bring their hands down simultaneously with a loud bang.

(*d*) **"Hammering".** The children lie on the front with the arms in yard position, hands clenched, little fingers against the floor. On the command: *Hammering go!* they bend the body backward and lift the arms; as they lower the body they bring the hands down heavily against the floor imitating the beat of a hammer. Done rhythmically till a halt is called.

(*e*) **Stretch Arch Front Lying, "Rocking" ("Rocking-Horse").** The command can be: *Front lying—down! With arms stretched upward, trunk backward—bend!* (Fig. 225). *Rocking-(horse)—begin!* The body is put into a rocking movement forward and backward.

FIG. 225.

Some children have difficulty in starting because they lift the arms and the legs at the same time. If they are told first to lift the legs and then, as the legs are lowered, to push off with their hands they find it easier to start the movement.

24. **"The Kangaroo."** Same position as for "wheelbarrow" (pp. 322 and following). No. "twos," supporting, lift their partner's legs well up under their arms by gripping well forward on their thighs. No. "ones" hook their feet together on the backs of No. "twos" and grip firmly with their legs. As No. "twos" advance slowly, No. "ones" jump both hands off the floor by a vigorous push, and, aided by their partners, raise the body for a moment high up into front arch lying, first with the arms hanging down, later with the arms swung to stretch position. No. "two", who has helped his partner up by bending a little backward, moves forward a step or two before No. "one" again places his hands on the floor (Fig. 226). The jumps are gradually made higher and longer.

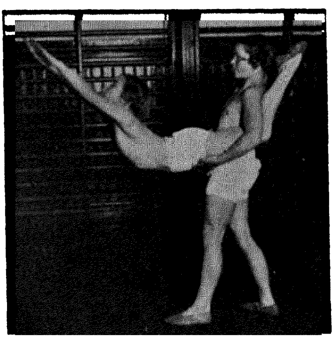


FIG. 226.

25. **"Mangling."** The children are facing one another in pairs in cross sitting position, knees touching, they join hands or take wrist grip. No. "one" lies down on his back and No. "two" reaches forward and moves with him in a trunk leaning forward, the back quite straight. No. "one" is now pulled up and the position is reversed. The children are supposed to be pulling an old-fashioned mangle.

26. **Pulling the Stick.** The children sit facing one another in twos; they are in long sitting position, the soles of the feet against the soles of their partners' feet. They may either grasp a stick, join hands, or take wrist grip. While keeping the legs straight each one tries to raise his partner off the floor. The children should be paired off according to weight and strength. The exercise is a test of the strength of the back muscles and should be taken with a certain care.

27. **Pulling in Pairs with Ring Grasp.** The children stand in pairs facing each other, give both hands to each other, put one foot forward, and on a given signal each tries to pull his fellow over to the wall.

28. **Drag (Deep) Stoop Grasp Standing, Leg Raising ("Reverse Hanging").** Wall bars. The children stand facing the wall bars a short step away, put their hands on their backs with the palms backward (at first one hand inside the other), bend right down and forward, bend the knees at the same time, and put their shoulders against the wall bars; after this they grasp a bar with their arms stretched (thumbs toward each other), and raise their legs up to the vertical position—first through a bending of the knees, later with straight knees. In the return movement the pelvis is held against the bars as long as possible to prevent the legs coming down too quickly; it also helps to prevent this if the legs are bent as they are brought down. After some practice, however, the legs can be kept straight. The feet are put on the floor quite close to the bars as it is otherwise too difficult for the children to raise themselves up.

§ 22. Breathing Exercises

In spite of the fact that we all draw breath several times every minute throughout life, the movements of breathing are performed incorrectly by many individuals, And this is principally due to the fact that the conditions of modern civilised life do not give us sufficient opportunity for physical activity.

Superficial breathing and mouth breathing are the faults most commonly met with.

During *superficial breathing* inspiration is caused by only slight movements of the joints of the chest and slight contractions of the diaphragm; and expiration is caused almost exclusively by the elasticity of the lungs, the thorax and the abdominal muscles, which latter have been somewhat extended by the contraction of the diaphragm during inspiration and its consequent pressure downward on the abdominal organs.

If this superficial breathing becomes the standing habit so that one never breathes deeply and fully, the thorax will adapt itself accordingly. The joints of the ribs, moved only slightly as they then are, become stiffer just like any other joint in which only small movements take place. The costal cartilages gradually lose their elasticity, and this is also conducive to a minimising of the mobility of the thorax. At the same time the muscles of ins- and expiration, only being allowed small contractions, will lose the ability to make large contractions. The diminished mobility of the ribs manifests itself through a smaller difference in chest girth in the positions of deepest inspiration and expiration. In young men with mobile chests the difference ranges from 4 to 6 inches.

Stiffness of the dorsal spine is also promoted when the movements of stretching and bending accompanying deep breathing are never performed.

The lungs, however, suffer most, because in superficial breathing only a small part of them is used, that part, namely, lying up against the region of the floor or the walls of the chest cavity which is being moved, in most cases the parts lying against the diaphragm (Professor L. Hofbauer). In the other parts there will not be sufficient ventilation and expansion and contraction of the tissues to bring about a normal circulation of blood in the lungs, which is so necessary to the nourishing, the efficiency and the hardening of the lungs.[1]

When people accustomed to superficial breathing are exposed to exertion, they can only obtain the greater supply of air required by increasing the rate of breathing; they cannot make their breathing deeper and they get out of breath. And if the exertion is further increased they cannot provide themselves with sufficient air, and so are unable to perform the work required.

Mouth breathing is undesirable for many reasons. The air is not warmed, purified and moistened; the mouth and the

[1] During deep breathing "the ventilation is improved in those parts of the lungs which are fairly inactive in ordinary breathing; all parts of the lungs are expanded, also blood vessels and bronchi; they are all moved and that seems to be of great importance to the lungs, their health, their power of resistance to disease, and their power of healing, in other words, 'the vitality of the cells of the lungs, which we still must consider the principal weapon against tuberculosis' " (D. Rancken).

throat become dry, causing a feeling of thirst. When breathing is not performed through the nose, this—like any other organ which is not used as it should be—will lose its ability to function properly. Its mucous membrane will be hypersensitive, consequently the flow of air will make it swell because of an overfilling with blood, and the passages will be somewhat blocked. A blocking of the nasal passages is not necessarily caused by adenoids or other growths requiring an operation. Systematic practice of nasal breathing may be all that is required to put matters right (L. Hofbauer) ; little by little the hypersensitiveness of the mucous membrane may be lowered so that the nose once more may be able to fulfil its task as a protective organ to the lungs.

A young person who has led a sedentary life and thereby has become accustomed to superficial breathing, with the consequence that the mobility of the thorax and the power of the breathing muscles have been reduced, can to some extent develop his breathing mechanism by taking up physically strenuous work or physical exercises. In this manner the thorax will become more mobile and the muscles of breathing stronger. But during the movements of breathing, as during most movements involved in ordinary daily work, the joints are not moved fully and the muscles are not made to work from the greatest lengthening to the greatest shortening. And the reason is that quick and shallow breaths are necessary when the breathing mechanism makes some resistance, however slight. The exercises making for flexibility of the breathing mechanism must be taken when the breathing is calm.

The points to aim at during a training of the breathing mechanism are :—

1. Increased mobility of the thoracic spine, both as regards stretching and bending.

2. Increased mobility of the joints of the ribs both as regards rib raising and rib lowering.

3. A training of the muscles producing the greatest stretching and bending of the spine and of those muscles that produce a maximum raising and lowering of the ribs.

4. A training of the diaphragm so as to secure the strongest contraction during inspiration and a complete lengthening of it during expiration.

The breathing mechanism may be trained by the aid of *passive exercises* during which shortened ligaments and muscles are stretched, and *active exercises* that strengthen the muscles which move the thorax, *i.e.*, the spine and the ribs, and train them to work from the greatest lengthening to the greatest shortening.

The best *passive exercises* are the passive span bendings, viz., shoulder stretchings and stretch back support hanging span bending exercises (pp. 219-222). These exercises, more than any others, are able to make the thorax mobile, and not the joints of the spine only, but also the joints of the ribs. The mobility produced is in one direction only, however, as the movements performed are a stretching of the spine and a raising of the ribs.

It is this effect that makes the passive span bendings particularly valuable. As regards their ability to make the thorax mobile in the direction where the overcoming of stiffness is by far the most difficult, they surpass all other exercises. Anyone wishing to keep his thorax mobile during advancing years should practise these and similar exercises.[1]

In stretch hanging exercises, the pectorals, major and minor, pull on the ribs and raise them as much as the abdominal muscles allow, and it should not be forgotten that short abdominal muscles check the raising of the ribs as well in hanging exercises as in span bendings. A lengthening of such muscles is therefore necessary in order to make the chest mobile.

All arm exercises during which the arms are carried fully to the stretch position also raise the ribs which Fig. 77, p. 183, compared to Figs. 75 and 76, clearly shows.

We have no purely passive exercises to make the chest mobile as regards bending forward. But mobility in that direction is fully obtained by the many trunk bendings downward which are used so extensively nowadays (pp. 339 and following).

The rib joints are made mobile as regards a lowering of the ribs by the pull of the abdominal muscles during deep expirations.

[1] It is due to a misunderstanding of the effect of these exercises when certain advocates of gymnastics for women call them unsuitable and advise against the use of them. They make the chest mobile and they improve the carriage. They are amongst the best means of preventing the forming of that protuberance over the 7th cervical vertebra which is dreaded by women as one of the first signs of the weight of years and which is caused by a faulty carriage of the spine at the junction between neck and back.

We have no passive exercises by which to obtain this effect.

Active exercises for the muscles working in deep breathing must be exercises partly for the breathing muscles proper, the diaphragm and the intercostals, and partly for the accessory breathing muscles.

The training of the breathing muscles proper must essentially be done through deep-in- and expiration.

During *deep inspiration* the thoracic cavity is augmented partly by a lowering of the diaphragm and partly by a raising of the ribs and a straightening of the dorsal spine.

When the diaphragm during a full contraction presses the intestines downwards and sideways, it must overcome the resistance from the abdominal muscles which are being extended. In many individuals, the diaphragm, owing to lack of training, can overcome this resistance in far too small a degree, so the inspiration becomes shallow. By making the diaphragm contract freqnently and fully, from the greatest lengthening to the greatest shortening, it will be made stronger like any other muscle. During inspiration it must be made to press the intestines further and further down by still greater shortening.[1]

The ribs are raised during deep inspiration not only by the external intercostals, but also by the accessory muscles, viz., the levatores costarum and those from the neck and the head to the chest : the sterno-mastoids and the scalenes, the head and neck being fixed by the cervical erector spinæ ; they are furthermore raised by the dorsal erector spinæ, and by the pectorals, major and minor, when the arms are raised sideways and particularly upward (compare p. 178 ; it is the outward rotators of the shouder-blades working together with the deltoids that raise the ribs while the pectorals are acting as ligaments).

The external intercostals are trained by deep inspiration only The above-mentioned accessory muscles of inspiration are trained, as explained before, in all arm exercises in which the arms are brought into the stretch position, but first and foremost in active span bendings. These latter, like the passive span bendings, are important exercises as regards the training of the breathing mechanism. The dorsal erector spinæ are developed by neck exercises, particularly head support hanging and other

[1] In France certain breathing exercises are taken in back lying position, each pupil supporting a weight, *e.g.*, a sand bag, on his abdomen. This tends to strengthen the diaphragm as during inspiration it has to overcome the additional resistance due to the raising of this weight. A strong diaphragm may be able to raise a weight of 50-100 lbs.

similar neck exercises (pp. 206 and following), by front lying exercises, by stoop standing trunk stretching forward, etc.

In *deep expiration* the capacity of the chest is lessened, partly by the diaphragm being pressed upward, and partly by the ribs being lowered. Both movements are caused by the abdominal muscles, which are by far the most important accessory muscles for expiration.

The diaphragm, as stated, is pressed upward into the chest cavity by the contraction of the abdominal muscles. If accustomed to shallow breathing only it cannot contract fully, but correspondingly it cannot extend fully and consequently cannot be pressed sufficiently far up into the chest. The abdominal muscles must make its fibres longer little by little. The more they contract, the higher they press the intestines upward and with them the diaphragm, causing a lengthening of it. Well-developed abdominal muscles are therefore necessary for deep expiration ; and not only must they be strong, but they must also be able to shorten greatly. In this connection the transverse abdominal muscle should not be forgotten. Like a broad belt across the abdomen, it is able by its contraction to draw the abdominal cavity together.

By their contraction not only do the abdominal muscles push the intestines upwards, they also draw the ribs downwards and flatten the chest so that its diameters from front to back and from side to side are lessened. It is, as stated, by this pull on the ribs that their mobility in a downward direction is increased. The strongest effect on the joints of the ribs is obtained when the spine is not allowed to bend forward but is kept erect by the erector spinæ[1]. It is, however, also possible to lower the ribs during expiration by rounding the back and bending the trunk forward. By that the chest is pressed down on to the abdominal organs which in turn push the diaphragm upwards. But it will easily be seen that a complete downward movement of the ribs in their spinal joints cannot take place. It is, however, in these joints that we wish to increase the mobility. In the case of very mobile ribs one is able to expire just as much air by a lowering of the ribs alone as by a simultaneous rounding of the back.

[1] That the erector spinæ are active when the abdominal muscles pull downward on the chest during deep expiration is easily felt when the back muscles are tender or painful as during an attack of lumbago. Coughing and sneezing, both combined with a forcible expiration, will then cause a severe pain in the dorsal muscles.

Mobile rib-joints and well-trained breathing muscles functioning easily and unhampered are thus absolutely necessary for full breathing.

But is such a training of the breathing mechanism necessary for others than those who are called upon to perform great physical exertion ? Is it for ordinary people worth while to go through the training necessary in order to be able to breathe deeply occasionally ?

The answer must be, "Yes." Full and deep breathing has many advantages, the most important of which will be briefly mentioned here.

During deep inspiration a greater number of air-sacs is extended and the surface along which blood and air meet in the lungs will increase. At the same time the flow of blood to the lungs will be easier and the gaseous interchanges between the blood and the alveolar air will be quicker. When more blood flows to the lungs a correspondingly greater amount must flow from the lungs to the heart. The heart will be fuller and the amount of blood sent out in each heart beat will be greater. This results in a slower pulse and easier work for the heart (D. Rancken). Respiration and circulation are under normal conditions interdependent. The quicker the breathing, the quicker the heart beat, and vice versa.

The alternate extension and contraction of the lung tissue caused by deep breathing will mean better nourishment of the tissue than when breathing is shallow, and this again means greater resistance to illness such as tuberculosis (L. Hofbauer).

By deep inspiration the negative pressure in the thorax increases, and there will be a greater suction of blood from the abdomen towards the heart by which the circulation of the blood is assisted at the most difficult point.

In deep expiration, which is just as important as deep inspiration, the lungs are emptied to a greater degree than in shallow expiration. By the subsequent inspiration the composition of the air in the lungs will be richer in oxygen and poorer in carbon dioxide, which means a quicker gaseous exchange in the lungs when it is necessary on account of exertion. The difference between a shallow and a deep breath as regards the composition of the air in the lungs is very great. An ordinary shallow breath amounting to about half a litre will renew only one-seventh of the air in the air-sacs. If the breath is increased only to two litres, five sevenths of the air will be renewed.

During deep expirations the rhythmical pressure of the abdominal muscles on the abdominal organs will increase, also the pressure on the large amount of blood which they contain. This means a quicker flow of blood from the large glands and from the inferior vena cavæ towards the heart. By this also the heart is considerably assisted. Furthermore, the rhythmical pressure on the stomach and the bowels will act as a thorough kneading and will hasten the flow of the contents of the alimentary canal (L. Hofbauer).

Deep breathing is of special importance during growth. Besides the above advantages it also provides a stimulus to the growth of the lungs and the chest as well as to the muscles of that region, thereby procuring a better carriage (L. Hofbauer).

We look upon it as a matter of course that arm swinging is practised in order to make the shoulders supple, that trunk bending downward is taken in order to make the hip-joints and the loin supple, body raising to strengthen the heaving muscles, etc. But we do not take it as equally natural to use special exercises in order to develop the breathing mechanism. Proper breathing is, however, so important to our physical welfare that we ought to work deliberately in order to make the breathing mechanism also as efficient as possible.

Our breathing will adapt itself automatically to any exertion by the carbon dioxide of the blood stimulating the respiratory centre chemically. But we have known for a long time that this automatic regulation is not sufficient when one wishes to attain the best possible results in games and athletics. The object of the chemical regulation is to provide the blood with a sufficient supply of oxygen ; whether that is done by shallow or by deep breathing seems of no concern. If a child during growth indulges in powerful physical exertion (particularly running) sufficient to secure normal development, we must take it that its breathing mechanism, too, will be developed normally. But civilised life is a hindrance to such normal development; and when the thorax has lost its normal mobility and its muscles their normal strength and length, we cannot dispense with a special training. Athletes know that through an improved breathing technique they must learn to combine deep breathing with the exercises in order to obtain the best results as regards strength and endurance.

As already mentioned, the special exercises for the development of the breathing mechanism should be taken when the breathing is calm. Such exercises are the breathing exercises described below. Exercises which, besides other effects, make the spine and shoulders supple and strong (such as span bendings, arm exercises, trunk bendings, etc.), are not included. When performing breathing exercises the aim should be to make both the inspiration and particularly the expiration as deep as possible. During inspiration the diaphragm should be contracted strongly and the ribs raised as much as possible, and during expiration the aim should be an extreme shortening of the abdominal muscles in order to secure a maximum lowering of the ribs and a maximum raising (extending) of the diaphragm.

A special exercise deserves mentioning. Many children, particularly those who have worn tight-fitting garments, have used their diaphragm too little, and, consequently, are not able to control it properly. For their sake in particular deep in- and expiration should be practised. It is best done in back lying position. The children place one hand on the abdomen, and they now try to push it upward as far as possible during inspiration and try to draw in the abdominal wall as much as possible during expiration.

It is also good practice to make the children count how few breaths in back lying position they can take in the course of, say, half a minute, while taking the deepest possible breaths and keeping the breathing going the whole time. The teacher may check the best pupil by making him repeat and demonstrate the breathing test before the class.—To increase the work of the diaphragm one can also let them press both hands down against the abdomen during inspiration.

During physical exercises, in the gymnasium as well as the games field, the teacher must imprint upon his pupils the necessity to breathe freely and through the nose. They must train themselves in allowing the breathing muscles to work unhampered by the other muscles which are active during their physical exertions, so that the breathing is checked as little as possible. This localising of the muscular work (compare p. 36) is most important, and most people need to learn it. It is very common to hold the breath during any exertion, not only when it is difficult to avoid this, but also in other cases. It has become a habit, a habit which may readily be counteracted during gymnastics, as here it is easier for the teacher to observe, instruct and correct the pupils than during other forms of exercises.

When breathing exercises are used after fatiguing exercises one should differentiate between *localised* and *general exertion.*

Localised exertion is met with in all localised exercises demanding transitory exertion. The rhythmical way of working, especially in quick time, may also cause localised exertion although the exercises be easy. Instead of making the pupils perform a long series of exercises without any stop (often seen in extreme forms of dynamic gymnastics), a pause now and then with a breathing exercise inserted would be useful and pleasing to the pupils (and pleasing to the spectators as well). The pupils would become just as warm in this way, for it is a well-known fact that a few deep breaths may help to produce perspiration.

The work done in localised exercises is not very great measured in kilogrammetres, even though certain groups of muscles may be working very much. These exercises may quicken the respiration and the heart beat fairly suddenly, but both functions will soon calm down again. Breathing exercises further the calming down considerably, and they have a beneficial effect because they promote the circulation of the blood and ease the heart. In this respect they belong to the so-called depleting exercises and are without doubt the best of them. It is a deep-breathing exercise of this kind which one does involuntarily after a hard pull or when stretching oneself after sleep or after prolonged sitting.

The respiratory metabolism is as a rule not great in localised exercises. There is, consequently, nothing to hinder one from taking the breathing exercises in joint-time, but they may also be taken in individual time.

General exertion is not caused by many of the gymnastic class exercises. Running causes it to a considerable degree when prolonged suitably. If the respiration and the heart beat have been accelerated by such running, it would be injudicious to call a halt and command a deep-breathing exercise. That would disturb the normal functions. The sudden transition from violent exercise to rest is bad for the heart, and even the quickest breathing exercise cannot be performed as quickly as it ought to be in order to suit the quicker rate of breathing, consequently the ventilation of the lungs will be hindered and not increased. After some marching exercise has been taken the breathing and the heart beat will be reduced to such an extent that breathing exercises may be done with benefit. Individual rhythm will be the most suitable here.

When commanding breathing exercises one must suit the time to the momentary condition of the pupils as regards their breathing. If the rate of breathing is quick a breathing exercise which can be performed sufficiently quickly must be chosen. As the breathing calms down the time is made gradually slower. It should be noticed that breathing exercises taken as depleting exercises after fatiguing work (whether localised or general) should never be carried out through their full range; this latter can only be done when the breathing is at its normal quietness.

In individual exercises such as heaving exercises, jumping, etc., as a rule more fatiguing than class exercises, there is always a pause of rest after each performance. Here there is never any question of common breathing exercises; each individual by himself must manage to calm his breathing. If the exercises follow in quick succession he will feel that he has every reason to take a few deep breaths during the short pauses.

Breathing exercises belong in particular to the final exercises. The whole body has by now been thoroughly exercised and warmed, all joints are as mobile as possible, there is a lively circulation of blood through their muscles and ligaments. The whole breathing mechanism is now susceptible to influence, and this condition should be made use of to the advancement of its development and perfection.

Far back in the history of physical exercise—thousands of years back—breathing exercises are mentioned. They are met with in all systems from the Far East to the Far West. They are spoken of as a very important, if not the most important part of the exercises.

Their extensive use through the ages and their power of withstanding changing fashions speak for their lasting value.

"It is justifiable to demand that physical education must include the training in the technique of breathing so that all may learn to perform deep breathing correctly."

"As a test of the value of physical education the condition of the thorax must always take an important place."

"The elimination of breathing exercises must be looked upon as a fashionable whim from which gymnastics ought to free itself speedily." (D. Rancken).[1]

[1] In preparing the chapter on breathing exercises, about which opinions differ, works by D. Rancken, M.D., Professor of Physiology, University of Helsingfors, and by Professor Ludvig Hofbauer, M.D., Vienna, have been used.

1. **Standing, Deep Breathing with Head Bending Backward.** *Deep breathing with head bending backward*—1—2. The head movement is performed as described on pp. 201 and following, a deep inspiration being taken as the head is bent backward, and a deep expiration as it is raised again. This exercise can be combined with arm turning outward, or the arms can be in wing position and pressed well down on the hips, which stretches the upper part of the trunk. It can also be taken as a half trunk bending backward.

2. **Standing, Deep Breathing with Arm Raising Sideways.** *Deep breathing with arm raising sideways*—1—2. The arm movement is performed as described on p. 194, combined with deep inspiration and expiration, and a slight pressing backward of the head during the inspiration.

This exercise can be combined with heel raising.

3. **Yard Standing, Deep Breathing with Arm Raising Upward.** *Arms sideways—raise! Deep breathing with arm raising upward*—1—2. The arm movement is performed as described on p. 195 in connection with deep inspiration and expiration, and a slight pressing backward of the head during inspiration (see also Figs. 75 and 77, pp. 181, 183).

This exercise can be combined with heel raising.

4. **Standing, Deep Breathing with Arm Raising Sideways-Upward.** *Deep breathing with arm raising sideways-upward*—1—2. The arm movement is performed as described on p. 195, combined with deep inspiration and expiration, and a slight pressing backward of the head during the inspiration. The hands can be turned by an arm turning outward from the erect position, and kept turned until the erect position is reached again.

The exercise can be combined with a heel raising during the movement of the arms from yard to stretch position.

5. **Standing, Deep Breathing with Arm Raising Forward-Upward, Lowering Sideways-Downward.** *Deep breathing with arm raising forward-upward, lowering sideways-downward*—1—2. Performed as described on p. 195, combined with deep inspiration and expiration, and a slight pressing backward of the head during inspiration.

The exercise can be combined with heel raising during the movement of the arms from reach to stretch position.

SUMMARY OF TECHNICAL TERMS USED IN GYMNASTICS

Across bend (Acr. bd.)—The elbows raised level with the shoulders, strongly bent and pressed back, forearms horizontal in front of the upper arms (p. 185, Fig. 80).

Arch—The trunk bent in an arch backward (p. 282, Fig. 158).

Arch hanging (Arch hg.)—The body hanging in straight arms, and bent in an arch backward ; knees stretched ; toes on the ground.

Back lying (Bk. ly.)—The body stretched out on the back (p. 305).

Balance hanging (Bal. hg.)—The hands supported on a piece of apparatus, shoulder-breadth distance apart ; the body borne by, and hanging down between, straight arms.

Bend (Bd.)—Arms bent in the elbows as strongly as possible, upper arms pointing downward, forearms upward, hands out to sides of shoulders (p. 169, Figs. 64, 65).

Close standing (Cl. st.)—Feet pointing straight forward, inner edges touching from heel to toe (p. 145).

Crook hanging (Crk. hg.)—Body hanging in straight arms, knees raised, thighs horizontal, lower legs vertical (p. 308, Fig. 179).

Crook sitting (Crk. sit.)—Sitting position on floor, knees bent, heels together (p. 233).

Crook standing (Crk. st.)—The one knee raised, thigh horizontal, lower leg vertical (p. 292, Fig. 166).

Cross sitting (Crs. sit.)—Sitting on the floor with the legs crossed and the knees bent outwards. The back straight (p. 164, Fig. 57).

Drag (Dg.)—The straight arms moved backward as far as possible, with the shoulders and trunk in erect position (p. 190, Fig. 82).

Ear (Ear)—Hands on the top of the neck or top of the head (high ear), with elbows pressed well back (p. 167, Figs. 60, 61).

Fall angle hanging—The body hanging in arms, hip-joints bent, knees stretched, feet supported or raised (p. 211, Fig. 99).

Fall hanging (Fall hg.)—Body hanging in straight arms, held in an oblique position, with back downward and heels resting on the ground. The arms at right angles to the body.

Fall sitting (Fall sitt.)—The trunk inclined backwards with straight back from sitting position by a movement in the hip-joints alone (p. 314, Fig. 183).

Fixed—One foot fixed by the ankle in the wall bars or the like (pp. 259-260, Figs. 132, 133).

Flight (flight)—Arms raised sideways above shoulder level to a position halfway between yard and stretch (p. 188, Fig. 81).

Front hand lying (Fr. hnd. ly.)—The body lying stretched out with chest downward, resting on straight arms, which are at about right angles to the body, and toes underbent; hands and feet on the same level (p. 293, Figs. 168, 172). *Branches of Front Hand Lying.*—(*a*) High fr. hnd. lying: Hands higher than feet (p. 296, Fig. 169). (*b*) Deep fr. hnd. lying: Feet higher than shoulders (p. 301, Fig. 175). (*c*) Vertical fr. hnd. lying: Feet as high as possible (p. 303, Fig. 177).

Front lunge standing (Fr. lunge st.)—One foot moved 3 foot-lengths backward, front knee bent (p. 150, Fig. 47).

Front standing (Fr. st.)—Facing apparatus, fairly close to it.

Grasp—The one hand or both hands grasping a piece of apparatus with a firm grip (pp. 249-250, Figs. 140, 141).

Half kneeling (Half kneel)—One knee on the ground about a foot-length behind and a little to the side of the forward foot; trunk vertical over the knee (p. 289, Fig. 163).

Half stretch (Half str.)—The one arm stretched upward (p. 184).

Hand standing (Hnd. st.)—Body in about vertical position, standing on the hands.

Hip support (Hip sup.)—Hip or upper part of thigh supported against a piece of apparatus (p. 261, Figs. 135, 136).

Kneeling (Kneel)—The knees on the ground a foot-length apart, heels together, trunk vertical over the knees (p. 289, Fig. 164).

Kneel sitting (Kneel sitt.)—As kneeling, but sitting back on the heels (p. 246, Fig. 120).

Lean standing (Ln. st.)—A leaning forward of the trunk from the hip joints, back straight (p. 334, Fig. 201).

Long sitting (Long sit.)—Sitting on the floor with the legs together and stretched forward (p. 246, Fig. 121).

Lunge forward standing (Lunge f. st.)—One foot moved 3 foot-lengths straight forward, front knee bent (p. 150, Fig. 47).

Lunge outward standing (Lunge o. st.)—One foot moved 3 foot-lengths obliquely forward in its own direction, or obliquely backward (lunge backward-outward) in line with the stationary foot, front knee bent (p. 147, Fig. 44).

Reach (Rch.)—The arms stretched horizontally forward, shoulder-breadth apart, palms facing (p. 184, Figs. 78, 79).
Ride sitting (Ride sitt.)—Riding position on a piece of apparatus (p. 246).
Run standing—The one leg stretched backward, toe about a hand's-breadth from the floor.
Side Falling (Side fall.)—The body stretched out in oblique position, with the side downward, resting on the edge of one foot and on the straight arm of the same side, which should be as far as possible at right angles to the body (p. 265, Figs. 139-142).
Side standing (Side st.)—Arrangement at a piece of apparatus with side towards it.
Sitting (Sitt.)—Ordinary sitting position on a piece of apparatus (p. 314, Figs. 183-185).
Speech (speech)—As Drag but with the palms of the hands turned outward (p. 191).
Spring sitting (Spr. sitt.)—The knees bent as far as possible and pressed strongly outward, heels raised (p. 156, Fig. 54).
Spring standing (Spr. st.)—Knees bent to right angles and pressed strongly outward, heels raised (p. 153, Fig. 49).
Standing (St.)—The erect standing position (p. 104, Figs. 28, 29).
Stoop standing (Stp. st.)—The trunk bent forward and downward by a movement in the hip-joints and a bending in the lower spine (p. 339, Figs. 204-206).
Stretch (stch.)—Arms stretched upward, palms facing (p. 174, Figs. 69, 70).
Stride standing (Strd. st.)—Both feet each 1 foot-length straight sideways, or the one foot moved 2 foot-lengths sideways (p. 145).
Support—One or both hands or feet supported on a piece of apparatus (p. 154).
Toe standing—Heels raised as high as possible and kept together (p. 152, Fig. 48).
Touch standing (Tch. st.)—The one leg stretched backward (b.-o., s., f.-o., f.), the toe touching the ground.
Twist—Trunk twisted to the side on its long axis.
Walk outward standing (Wlk. o. st.)—One foot moved 2 foot-lengths obliquely forward in its own direction (p. 146, Fig. 43).
Walk forward standing (Wlk. f. st.)—The one foot moved 2 foot-lengths straight forward or backward (p. 146).
Wing (Wg.)—Hands placed on hips, thumbs behind, elbows a little back (p. 167, Figs. 58, 59).
Yard—Arms stretched horizontally out to the side (p. 172).

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