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PHYSICAL DEVELOPMENT

AND

EXERCISE FOR WOMEN

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BY

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PREFACE.

TO make an already good thing better, not to lead a forlorn hope for improving incurable invalids, would seem to be the privilege of the American girl as regards her own physique.

Physically equal, as we believe she is upon the whole, to her traditional great-grandmother, her opportunities to add to her present stock of health are infinitely greater than were accorded to this ancestor. The obstacles to her better physical development are for the most part due to ignorance and to custom; and these, beginning in her early years and continuing to maturity, largely concern her school-life, the restriction of her body by dress, and its limitation from lack of sufficient exercise.

Her direct environment, so far as it concerns the essentials of fairly healthy homes, an abundance of food and sleep, and the absence of exhausting

toil during the period of growth, is generally favourable to physical development; and for that reason the influence of food and kindred topics have not been included in this little volume. The intention has rather been to lay stress upon the conditions, already alluded to, which affect girls as a class, everywhere, the conviction being absolute that the physical development which might be theirs can only be gained by a reform in these conditions as they now exist.

The writer seizes this opportunity to express her cordial thanks to the two ladies who kindly posed for the photographs from which the illustrations of the book are mainly taken, as well as to those who allowed her the opportunity of taking some special measurements here mentioned.

M. T. B.

CONTENTS.

PHYSICAL DEVELOPMENT.

CHAPTER I.

SYMMETRY AND HEALTH.

THE ideal of health is that happy condition of unconsciousness of the body which is only possible when every part of it is perfectly developed and equal to the performance of its function. The embodiment of this ideal is, unfortunately, not a common one; and we shall, perhaps, have to turn to that picture of noble young womanhood with which we please our imaginations to find the combination of flesh and spirit which satisfies our sense of physical perfection.

Wherever she is found, this creature of grace and vigour, of health and activity, she will always answer to the one great requirement of harmony of structure, not only in outline but in entity. Graceful she must be, but she will be also something better than this; hers are the curves that mark a well-knit frame, supple in joint and strong in limb. Soft colour she will have, but her clear tints are only the visible sign of the active heart and

the generous lungs which mix this carmine for her cheek; while the reserve power that animates her pliant but vigorous figure is the power that comes from a well-developed and balanced nervous system which is the competent ruler of this beautiful kingdom. If we try to analyze the secret of her charm, we shall still find that it lies largely in the sense of harmony she gives us; and this not because we recognize her perfect outlines only (we are accustomed to the art dictum that calls for the proportion of one part to another, that demands a fine relation of shoulders and chest, waist and limbs), but also because we feel that the internal structures, upon whose health and harmony the maintenance of the entire body depends, are equally developed according to their laws of proportion. So that her graceful outlines are but the symbol of the harmony that rules within.

It should be made plain to all concerned that physical development, in its best sense, depends upon the harmonious growth of the entire organism. As a matter of fact, many of the familiar instances of ill health, deformity, and even disease, that we see about us are the result of the unsymmetrical development of one or another part of the body reacting upon the whole.

Let us look, for instance, a moment at the possible result to the body, in general, of an unsymmetrical development of the skeleton.

The function of the skeleton is to give solidity to the figure, to offer protective cages for the different vital organs, to form the organs of locomotion, and to afford points of attachment for the muscles which move the body. With all of these functions it is easy to understand that a failure of the skeleton to develop properly, either in shape or size or constitution, might have a serious effect both upon the health, vigour, and symmetry of the individual.

There is, in fact, a disease of the bones known as rickets, somewhat common among children, especially in foreign countries, which is a striking illustration of this point. In this affection the bones are deficient in lime salts, so that their unnatural softness permits them to be flattened, often seriously changed in shape, and pushed out of place through the weight of the body pressing upon them. The so-called bow-legs of children, sometimes seen among the poorer dwellers of a city, are generally due to this affection; and in severe cases the ribs and the breast bone may be so flattened or distorted and the spinal column may be so bent as seriously to affect the shape and reduce the diameters of the chest.

It will be easily imagined from what we know of the chest as a capacious cage containing the heart and lungs and blood-vessels which these organs are intended to fill, that anything which by reducing its size interferes with their full activity must have a serious effect upon

their development, and upon the health of the individual. Nature, we know, abhors a vacuum; and therefore if the chest cavity or thorax be capacious the lungs will expand and grow to fill it, the heart will be stimulated by their demands to grow to its full size, and the entire body will be the gainer in harmonious development. But if, through disease or lack of proper nurture, the growth of the chest be interfered with, the lungs cannot expand to their full capacity, the heart, lacking their stimulus, will be similarly limited, and the entire body suffers.

We find, in fact, that children who suffer from rickets have smaller lungs than others not so affected, and that partly owing to the unusual relation of their chest organs they are specially liable to respiratory diseases.

In marked cases of rickets we also find that the bones of the pelvis are seriously affected, so that this cavity is smaller than normal in some important directions, being flattened or otherwise deformed in shape. Such deformity occurring in girls has a most unfortunate result upon the functions of motherhood.

So that, as we have seen, an affection which at first thought appears to limit the growth of some of the bones of the skeleton only, is found in many cases to interfere, through this limitation, with the growth of the most vital organs of the body, and even if no actual deformity be present will seriously curtail the physical powers of the individual.

Fortunately, these extreme cases of unsymmetrical development of the skeleton are very rare, although the lesser degrees are quite common; but they serve as illustrations of the fact that health and beauty alike depend upon the law of harmony of structure and proportionate development of every part, and that, in the intimate relations that every part of the body bears to every other, deficient development of any one region cannot exist without affecting other regions unfavourably. And that which is true in these marked cases of disease is equally true to a lesser degree wherever bodily development is disproportionate.

A midget whose organs are all proportionately developed and vigorous, might possibly, in the sense of equalized power and health that results, have more satisfaction and every-day enjoyment out of life than a disproportioned giant, whose long legs gave him the locomotive power of a Seven-Leagued Boots, but whose lung development did not support him in their active use.

The harmonious development of the body has a very practical relation, not only to ideal health but also to our enjoyment of life, and for this reason: We shall find, whether in work or play, that the body is practically only as strong as its weakest part, and that instead of living up to the capacity of enjoyment of the healthiest and finest parts of our organism we are dominated by the vexatious limitations of our weakest; so that, physi-

cally, the poorest and not the best of us is the standard for what we can do or become.

The man with a magnificent frame and splendid muscles cannot save himself in a race for his life because way off in a corner of his heart is a tiny valve which has been leaking like a broken dam for years, and at the supreme moment of necessity this imperfection becomes the dominating element of his otherwise superb physique; so that instead of being able to endure fatigue with the vigour of his best organs, he is vanquished by the weakness of his poorest.

Equally true does the principle hold with the student, the athlete, the society girl, in large or trivial matters. The weakness of an unhappy stomach disorders a great imagination, a tired back ends the tennis game, a pair of weak ankles spoil the dance. Nine tenths of our body may be equal to the effort; but if the one remaining tenth has collapsed entirely, the sport for us is over. Which truth goes far to teach us how well it may be, for purely selfish reasons if for no other, to give to the growing body every opportunity for developing bone and muscle and brain and vital organs to their best capacity and in their most healthful relations, — not only for health's sake, or for art's sake, but also for the sake of the full scope and enjoyment of life.

If it be true, as it certainly is, that we have it in our power to affect the physical development of the body by

bringing certain influences to bear upon it, this must be because some of the laws that govern it are susceptible of modification. If we will take the trouble to consider for a moment by what slow degrees and far-reaching processes growth is affected, we shall perhaps more easily see some natural reasons why we are able to influence the body for better or for worse.

CHAPTER II.

HOW WE GROW.

ONE of the most fascinating studies for an intelligent curiosity is that of the ways and means by which a strong-limbed and conscious human being has been developed from the tiny and insignificant cell which we know to have been his origin. Doubtless some of its fascination lies in the mystery which surrounds it, for in the truest sense we do not know how we grow, nor how to explain the mysterious principle we call life.

Neither can we explain the miracle of the growth of a single morning-glory that we may have planted in embryo in our summer garden, its tiny black seed unattractive and hopeless to the eye; but we know that in due time, with the wooing of the sun and the dew and the summer wind it will issue from its dark robing-room in a dress of transparent azure or softest pink, to bloom an ethereal messenger from Nature's kingdom, — perfect, but unexplained. However, if we cannot explain the miracle we still enjoy ferreting out what little we can

about the conditions that favour its recurrence, and learning how we may help to furnish these. So if we cannot truthfully claim to know exactly how a human being grows, we do at least know something about the phenomena that attend its growth, and something about the conditions under which this is possible.

We have learned from scientific observers a few definite and important things about growth. We know that human beings, like all the rest of created things, originated from a single soft and almost formless cell, called the ovum. That this cell having divided into two, and these divisions still further dividing and subdividing, we have an aggregation of cells that we call the embryo. At first these tiny cells are all alike, and in the beginning of their existence have nothing to mark them as anything different in origin or destiny from the cells of the lowest polyp or the humblest plant. Little by little, however, this company of cells begins to increase in size, and, beginning also to disperse somewhat within the confines of their prison walls, they show at the same time a tendency to differ from one another, both in appearance and in function. And here comes in the principle of the division of labour in the body; for now instead of this aggregation of cells all trying to perform as best they can the same offices of digestion, respiration, and locomotion and all the other functions necessary to human beings, they become, on the contrary, specialists in their

community. Some are called to give solidity to this shapeless mass; these are the cells which are to secrete lime and other salts which help to form the skeleton. Another company is set apart to form the tissues which are eventually to move this skeleton; these are the muscles cells, which in time, along with the other changes taking place in their shape and appearance, develop the property peculiar to muscles, — namely, contraction. A third company fills the office of oxygen-carrier to the body at large; these are the red-blood cells, — while still another develops the power to supply fluids of various kinds which are essential to the solution and digestion of the body's food.

Then there are the cells whose high office it is to take command of all this varied community, to co-ordinate and combine their efforts into a harmonious whole, and to transmit the orders for action from the central governing department to all the different members. These, of course, are the nerve cells. And so we might go on, learning how from the simplest origin, by slow degrees of development, is gradually evolved this complex and complicated being, man.

It takes about twenty-five years to develop a human being from its original simple cell to the full size and power of a full-grown adult. A woman has generally attained her height before this, more commonly by the age of eighteen, but the complete solidification of all of

the structures and organs is not attained until later, and some regions of the skeleton are in fact not completely ossified until the age of thirty.

To insure this development, Nature in this period of time has matured over two hundred and eight bones in the skeleton and more than five hundred muscles. She has maintained in unceasing activity an organ which is sending from ten to twelve pounds of blood around the body in less than thirty seconds, and whose energy, at each contraction of its muscular walls, is equivalent to pumping an ounce of blood over fifty feet high.

In the interior of the body, where foods have been undergoing chemical and other changes to fit them for nourishing the tissues, the fluids necessary for their solution have been manufactured to the amount of twenty to thirty pounds daily. Oxygen has been required by the lungs to the amount of about two pounds every day, and from five to six pounds of food and drink have been required to make this constant activity possible. But all of this growth has not been accomplished by in-taking merely. For just as a well-kept furnace not only consumes fuel and gives out heat, but also produces ashes as a sign of its activity, so in the human body the consumption of food and the in-taking of oxygen give out heat and create new structures; but in this activity much waste material is also produced which must be constantly removed, like the ashes of the furnace, or

the life-fire will grow dull and become even fatally choked.

Some of these waste elements are eliminated through the lungs in the shape of vitiated air to the amount of seven or eight quarts per minute; some through the skin in the shape of water and solid substances, from one to two pounds daily, and in unusual exertion double that amount. The kidneys have carried off from three to five pints of fluid in twenty-four hours, much is eliminated through the intestinal canal, and every muscle and gland cell in the body has aided in this effort to purify and cleanse the interior from the waste materials which can only clog its machinery, and limit its power for body building.

And so by the development of some of our original simple cells into higher and more special forms, and by the ceaseless activities of all of the members of this busy human laboratory, adding to its structure little by little and throwing away useless elements, it has become possible for such a beautiful creation as the human form to be consummated.

Perhaps it will seem that we are even now trying to cover up our ignorance concerning growth with many words about it, but this hasty generalization has perhaps suggested this much to us: That the law of growth seems to be from extreme simplicity to great complexity; that with the human being this progress is not made in a

hurry, but that on the contrary, whereas one of the noblest of the lower animals, the horse, attains full maturity in about seven years, it takes a human being three or four times as long to reach even an approximate maturity of his power.

We have also learned that there are two forces always at work in this body building, — the one constructive, building up and adding to the original foundation, the other destructive, throwing off or eliminating materials no longer of any use to the building; and these two forces must be evenly balanced to maintain the health and development of the body. That is, if we take in so many pounds of food and drink daily and so much air, we must also throw off from the body through the different channels mentioned just as many pounds and as much air. When this income of material is greater than the output the activity of the various organs is hindered, the body accumulates fat, certain diseases may be engendered, and health is sure to suffer to a greater or less degree. When the output much exceeds the intake the body wastes away and its strength is lost, — as is frequently seen during fevers or other exhausting diseases where the patient is unable to take sufficient nourishment.

The object of our endeavours to develop the body should evidently lie in the direction of offering it such conditions of life as will maintain the proper balance

between these two processes, and some of these conditions will be discussed later on.

And finally, I think we must have noticed, as we thought how growth was maintained, that one of its great requirements is activity; not simply the general activity of the body as a whole, — the movement from place to place, the turning of the limbs and the action of the eye and lip and hand, — but that more constant and subtle activity of the cells themselves, which are the component parts of our body.

The blood cells which are ever carrying from one region of the body to the other their needful supply of oxygen, the muscle cells which are storing up some of this oxygen against the day of sudden exertion or of lack of food, the gland cells eagerly substracting from the passing blood and other currents the elements they require for their special work, the brain cells, still more marvellous, which are quietly elaborating the force which may perchance subdue an empire or electrify a nation, all bear their silent but eager testimony to the fact that only through activity are growth and health, and so life and beauty, possible.

And now, since we have seen how gradual the development of a human being must be, and by what elaborate and complex processes it is carried on, we can readily believe that it may easily be influenced for good or for ill according to the conditions of life that surround it.

And this is precisely what is happening every day. There is, fortunately, a certain law of growth by which all human beings attain *more or less* to the standard of the species to which they belong. This is, of course, what we mean by heredity, — the tendency that we all have to reach a certain average height and weight and chest girth and strength and physical likeness to our kind. And this tendency is always helping us to develop, and by it we are predestined to be like what went before us. But with such an impressionable thing as a growing human body, with its myriads of cells, all dependent for existence upon light and air and food and activity, which they may or may not find in due proportion about them, there are many chances that it may be diverted from its straight course toward complete development. And these chances are represented by environment, which is the sum total of all the influences that make up daily life; the supply of food and fresh air and sunlight, the influences of school-life and of dress and of exercise, the effect of occupation or of a life of leisure, — all have a tremendous effect upon growth and development, as facts and figures are capable of showing; and some of these influences we intend to speak of somewhat in detail.

Probably all of the girls who may read this book are liberally supplied with fresh air and nourishing food in their homes; but since we are convinced that the other

conditions which commonly surround girls — of dress, school-life, and lack of proper exercise — are largely responsible for their unsymmetrical and undeveloped bodies, we shall ask them to look more closely at these conditions, and see whether their probable practical influence is likely to be for good or for ill. The outlook need not be depressing, for if these conditions are evil they are all perfectly remediable.

CHAPTER III.

HOW ENVIRONMENT MAY INFLUENCE GROWTH.

SINCE we are not at all responsible for having been born either of vigorous or of puny parentage, but, being here, are now mostly concerned in learning how we can help ourselves to better ourselves, and in properly estimating what effect our life conditions have upon us, let us dismiss all questions about the curious transmission of physical perfections and imperfections, as seen in the great fact of heredity, and look at this other great factor in growth, — namely, environment. From such facts as we have, it would seem that surroundings have an immense influence upon the physical development of persons all the world over.

In the first place, since circumstances do not appear to have much influence upon the size of the new-born, — since female infants, for instance, appear to have an average size and weight the world over, regardless of their class or condition, — it would appear that some potent influences must have been at work to result in the enormous physical differences we see about us.

Practically speaking, all female infants have the average length of about nineteen inches. But we find that when they have grown to girlhood the girls of different social classes are very far from being equal to one another in height; and we find, too, that these differences are constantly increasing the farther we get away from infancy. An hereditary tendency to low stature, some one will perhaps say. Possibly, to some extent; but that this is not sufficient explanation facts like the following will show.

When children who are brought up in large cities, where the population is very dense, are taken to the country where there is more space and light and air for each person, they almost invariably show a great increase in height, and one out of all proportion to their previous growth, which would seem to indicate that their previous surroundings of bad air, poor food, lack of exercise, and perhaps too much work were largely responsible for their slow growth. Even among adults a change of residence from a less favourable to a more favourable climate has resulted in a marked increase in height, as was noticed in the case of many of our recruits during the late war.

The great social classification of rich and poor is, we shall see, a great physical classification as well. In the matter of stature alone it is estimated that the poor have only eighty per cent of the stature of the rich. That is, if the daughter of a well-to-do parent at the age of

eighteen is five feet two inches tall, her less favoured sister of the poorer classes will probably be two and a half inches shorter. If the well-nurtured girl weighs one hundred and twenty pounds, her poorer neighbour at the same age may weigh anywhere from fifteen to twenty pounds less. If our Hebe boasts a chest measure of thirty inches, the neighbour can only show one of twenty-eight; and so through all their physical proportions like differences show what nurture has done for one, and what the lack of it has subtracted from the other.

Then there is the influence that occupation has in favouring or retarding growth. We see the effect of this by comparing children of the same class and surroundings, one of whom works in a factory every day, standing on his feet, the other who goes to school, or who follows other trades not compelling the standing position.

The factory child, working against gravity all the time, will be found two to three inches shorter than his mate who is differently occupied, although their food and housing are practically the same.

Unfortunately, fewer facts have been accumulated about girls than about boys as regards the effect of occupation, exercise, town or country life upon their development; but since the principle involved is the same for both, we can accept the evidence for one as evidence for the other, so I shall make no apology for showing in the following table (page 21), by some help from Roberts's

statistics, how the height of English boys of the same age may be diminished or increased in direct proportion to their surroundings.

It is something like this: At the top of the scale, as we see, best developed of all, are the sons of the professional men, — the boys who go to Eton and Rugby and Harrow, well-housed, well-fed, and who above all, after the fashion of the best English boys' schools, have hours of healthy sport in the open air. These boys, we see, are fifty-five inches (four feet seven inches) tall. Next come the boys from the first and second "Middle-class Schools," kept in town, where sports are fewer, boys less out of doors, and living in less pure air. Then we have the children of agricultural labourers, only fairly fed, and when not in poorly kept schools probably on their feet working; these are two inches shorter already than the best-nurtured boy.

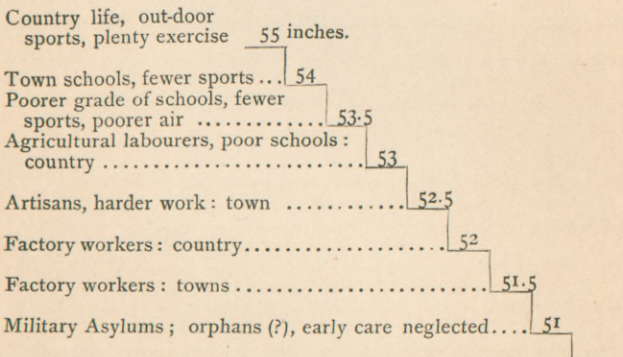
Then there are the children of artisans, town dwellers, constantly employed, breathing impure air, and taking no exercise worth mentioning. Next come the factory children who work in the country, and then those who work in town. No sports, no out-of-doors, always on their feet; but you see even here that the country-bred factory boy is ahead of the more confined town lad. And last, and shortest of all, as they have been least favoured by circumstances, come the children of asylums, who are generally orphans, with no physical nurture, little

exercise, and poor food both before and during their asylum life.

These boys are all between the ages of eleven and twelve years ; and grading them according to their height, we shall see how this is steadily lessened in direct proportion to their physical surroundings and habits of life.

Influence of Physical Nurture upon Height.

BOYS.



So we see that a difference of five inches may exist between two boys who were probably born of the same height, one of whom was favoured with healthful surroundings, the other deprived of these conditions of growth.

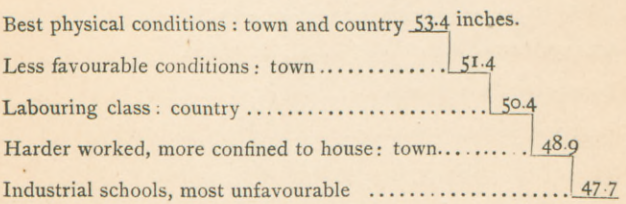
The observations among girls, as we have already mentioned, being less numerous, the diagram is less striking ;

but because this little book is for girls, we shall add another pair of stairs which will give some results obtained among English girls of different social classes, and therefore widely differing physical advantages.

Like the boys, the first class represents the children of professional men, who live in the same comfort, and with probably about the same physical advantages as to air, exercise, food, and the absence of fatiguing work as do the girls who will read these pages. These girls are ten years of age, and the scale descends in the following way: —

Influence of Physical Nurture upon Height.

GIRLS.



At the age of fifteen a similar pair of stairs shows the most favoured girl to be about five feet three inches tall (62.9 inches), while the girl who is on the lowest stair, an inmate of the Industrial schools, is, at the same age, seven inches shorter, or only 55.5 inches high!

In weight our topmost girl of fifteen years tips the scales at about one hundred and seven pounds, while the girl who has never had enough fresh air or vigorous

exercise, and probably not a very ample diet withal, is nearly forty pounds lighter !

These and similar figures are only illustrative of facts concerning which we have daily evidence ; for in a general way we all understand that their surroundings and physical education must make a difference to a nation, or to a family, in proportion to their greater or less healthfulness.

Probably none of my readers will ever work in factories, and doubtless all of them have liberal supplies of food, and fresh air in greater or less proportion, but a consideration of these few figures will, I think, tend to show them how seriously the external conditions and habits of life may interfere with symmetrical growth ; and they will therefore not be unprepared to have me claim that certain social and other conditions of life which do concern them may have a most important influence upon the development of a girl's physique.

There are three distinct conditions in the life of the average young woman which are certainly capable of seriously retarding her physical development, as they now exist, and these concern her habits of dress, habits of school-life, and habit of (*not*) taking exercise. And these three conditions, as they now exist, we shall look at a little more carefully in detail.

CHAPTER IV.

THE INFLUENCE OF DRESS ON PHYSICAL DEVELOPMENT.

IF we observe the outlines of any accredited statue of a beautiful woman we shall be struck with several interesting points of difference between them and those of the modern girl in modern attire. If we take the anterior line from the neck to the centre of the abdomen, we shall find that in our statue it presents two very gentle curves. The first, from the base of the neck downward, is a gradually swelling curve over the chest until it reaches a point just below the bust; then we see that the line becomes almost straight for a few inches until it reaches the region of the waist, when it once more curves gently outward and downward over the abdomen. In fact, the contour is such that the actual depths of the two regions, — namely, those of the chest and the abdomen, — are nearly the same, measured from before backward. The same figure gives us a similarly soft curve from under the arm outward and downward over the hip; and we notice how almost imperceptible is the

point at which these swelling curves begin and end, with no suggestion of sudden transition or sharpness.

These outlines are characteristic of the figures of all the beautiful women that art has given us in every age; and from them we see that in the ideal beauty women had no sharply defined waist (which is really a break in the curve), but only a continuous and beautiful curve in that region, and no suggestion of what women sometimes now complain of, — an "abdominous" figure, — but only a gently swelling outline, whose beginning and end were difficult to find. Evidently the same ideal of nature is held in the modern art world, for the artists' models tell the same story. "Have you a small waist?" (that is, a sharply defined curve) an artist's model was asked by one in search of a natural figure. "No," she replied, quickly; "if I had, the artists would not employ me."

Now, it is easy to see that our modern girl is not like the accredited statue in one or two important particulars. First, her upper chest curve is somewhat more accentuated, while the region below the bust, instead of being either a straight line for a little distance or even a gentle curve outward, is, on the contrary, often deeply indented, forming an actual concavity in the outline at this point, which we call the waist. At all events, there is almost always a sharp arrest in the gradual slope outward which challenges attention, the abdominal curve taking a sudden leap forward, just below this point, making, even in

young women, what may be properly termed an abdominous figure. If she is dressed, — the modern model, — these outlines result in the high bust, the stiff indented waist, whose concavity contrasting with the swelling curve below gives the conventional hour-glass figure.

It can be shown that these differences between the modern and the classic, as well as between the modern and the uncivilized woman, are entirely the result of the constrictions of modern dress. No Greek or Roman maiden possessed this curious outline, nor do we ever see a well-formed Indian or gypsy woman with an hour-glass figure. It has been reserved for modern civilization to invent the brace known as the corset, and to its slow compression women can now boast a figure like which there is nothing in the world of nature or of art.

One of the first innovations in this line of tight dressing was the linen band worn by ancient Greek and other women for the purpose of supporting the bust, but never with the intention of contracting or changing the figure. It is probable, however, that to this simple and legitimate fashion we owe, by slow degrees, the present one of supplying a bust supporter, a waist constrictor, and a general body depressor in the one article known as the corset. For as the human body is more than a mere outline, it goes without saying that any systematic compression of its anatomy must affect, not only its contour but also the structures and organs compressed. And briefly, these

are some of the grave charges that we bring against the modern corset, or against any system of compression analogous to it: —

First, it changes the shape of the chest, by compressing the lower and more movable ribs, and exalting the action of the upper chest region. It restricts the free action of the heart and of the lower portions of the lungs. It curtails the freedom of the diaphragm, the most important muscle of respiration. It weakens by its pressure all of the muscles which it constricts, — notably the abdominal muscles, whose vigour and tone are specially desirable in women, — while it offers the spinal muscles an artificial support, instead of the cultivation of their natural functions of holding the spine erect.

It tends to displace abdominal organs, — notably the liver, which is directly within the limits of its seizure, and which is pushed by this compression downward into the pelvic region, where it in turn exerts its pressure upon the pelvic organs. This pressure from above, allied to the fact that the diaphragm, whose activity greatly assists the pelvic circulation, is seriously crippled by compression, makes tight clothing, with its associated muscular weakness, largely responsible for many of the pelvic complaints which disable women.

The strength of all muscles depends upon their action in the line of their function, and for such action they must be free. Now, the corset makes action unnecessary

and freedom impossible, because it says to the waist muscles and the back and abdominal muscles, "Come, I will support you; lean on me. Your arms must grow strong with use, your legs become vigorous with action, it is true; but make no exertion with the muscles of your trunk, for I will support them by this splint." And so the growing girl who was just learning the enjoyment of her body, and beginning to develop its usefulness, is encased in whale-bones and splints; and after a year or two of artificial support she says very truly that she cannot hold herself up without it.

It will perhaps be easier to understand the influence of corset pressure by referring to the illustration (Fig. 1), which represents the trunk of the body and the regions most affected by tight dressing. We see here the bony cage called the thorax, formed by the ribs, breast-bone, and spine, which contains the heart and lungs. These twelve pairs of slender bones are all attached behind to the spine, but in front they are pieced out with cartilage, by means of which most of them are attached to the breast-bone, directly, or indirectly, varying with their position. The lower ribs, it will be seen, are more indirectly and obliquely connected with the breast-bone in this manner, while the last three are not attached in front at all, but float loosely in the abdominal cavity. It is evident from this arrangement, and it can also be demonstrated by experiment, that the lower part of the

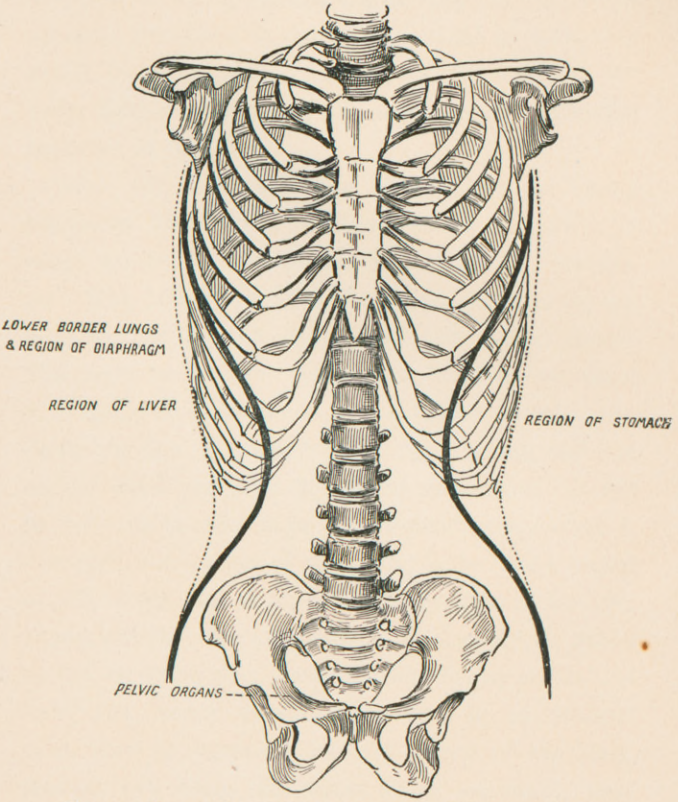


FIG. 1. SHOWING THE NATURAL AND THE ARTIFICIAL OUTLINES OF THE TRUNK.

chest and these floating ribs are easily compressed. The lowest ribs are in fact just at the waist line, where in all tightly dressed women they are continually squeezed together; so that if they could be seen, they would be found nearly meeting in the centre of the body, instead of showing the natural wide separation indicated in the plate.

Below the chest walls the plate shows the flaring hip-bones, which form the basin called the pelvis, in which are deeply located the uterus, ovaries, bladder, etc. The outer line gives the actual shape of an unrestricted body, with its gradual and gentle curves. The inner and heavier line gives the familiar shape of a tightly-dressed woman, and has been drawn to indicate the line of pressure of a tight corset, and the regions which are most injured by its seizure. It will be seen that in order to produce a small waist, — that is, a marked indentation of the figure, — the corset begins to pull in the ribs at about the lower third of the lung region, and that this compression is increased, as shown by the incurving line, until it cuts sharply across the lower ribs, clearly showing how these, in an artificial waist, must be squeezed into the center of the body, pressing with them the organs which are within their protection.

Just at this point of waist constriction is the great muscle of respiration, the diaphragm, which forms the

partition between the chest and the abdominal organs; and because it is such an important organ, and withal so little understood and so much abused, we shall pay it a little attention just here.

The name *diaphragm* means a dividing wall, and it is so called because it cuts off the chest from the abdominal cavity. The diaphragm indeed forms the floor

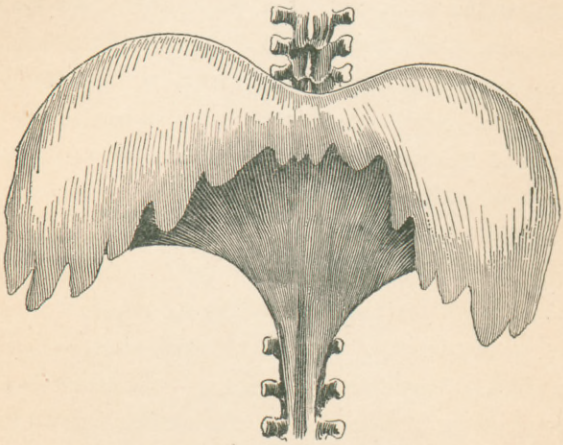


FIG. 2. THE DIAPHRAGM.

of the chest, and the roof of the abdominal cavity. By referring to the illustration (Fig. 2), which is copied from Kitchen, it will be seen to be irregularly dome-like in shape, some of its fibres also running downward and backward into flattened tail-like ends, which are attached to the spine. The sides are attached to the

ribs, while in front its deeply jagged edges fit into similar digitations in the muscles that close the abdominal cavity. In structure it is part muscle and part tendon, and it is so strong that it is estimated that in certain expulsive efforts it exerts a pressure upon the abdominal contents equal to over twenty pounds to the square inch. Underneath its two convex surfaces we find the liver and the stomach packed away with the spleen, kidneys, and other digestive organs, the diaphragm fitting down over them almost like a cap; and from their intimate relation it will readily be understood how the movements of this close-fitting cover must influence these and adjacent organs. There are three openings in the diaphragm, two of which permit the passage of blood-vessels from the heart into the abdomen and beyond, while the other transmits the œsophagus as it passes into the stomach.

Now, the great office of the diaphragm is to pump air into the chest; it forms the motive power by which not only breathing but all vocalization, — speech, song, coughing, and laughing,— are possible. Other muscles are aids to respiration; but they could all be spared before the diaphragm, which is the only muscle capable of carrying on abdominal breathing unaided. This alone suggests its importance, and the necessity of giving it ample room for its activity.

The diaphragm works something like a piston. In

inspiration its two dome-like surfaces contract, becoming flattened out, and so descending somewhat, and pushing downward the abdominal organs they enlarge the chest cavity vertically, while the ribs, at the same time moving outward, enlarge it laterally. This recession of the chest walls having formed a vacuum, air rushes in to fill the space, and so we have inspiration.

In expiration the diaphragm returns to its original position and dome like shape, partly by its own elasticity, and partly by the recoil of the abdominal organs which push it up as they regain their own position once more.

This, then, is the first great function of the diaphragm, and it is apparent how it must be limited in its usefulness if it is squeezed into a smaller space than nature provided for it.

The illustration of the diaphragm is intentionally made larger than it normally is in relation to the chest, so that its structure may be more clearly apparent. It is drawn as it would be in a state of expiration, when it has been relaxed somewhat. In inspiration these dome-like surfaces become flattened.

It can be imagined how the line that has been drawn to represent the compression of the ribs must also cut across the curved borders of these domes, compressing the organ, and restricting it in its ability to expand properly. We find by experiment that tight clothing,

be it corset, bands, or waists, does seriously affect its oscillations, and interfere with the quantity of air that can be taken into the lungs at any given time. If the diaphragm is limited in its movements, the chest is not properly enlarged at each inspiration, and there is consequently no opportunity for the lungs to expand fully in their lower portions. It will be noticed that about one third of the lungs lie below the point of beginning corset pressure, so that with tight corsets this amount of lung substance must be more or less useless, depending upon the degree of compression. The reason that women support this amount of lung compression as well as they do, is because the upper two thirds of the chest assumes extra work to compensate for the deficiency of the unused portion, which also explains why the upper chest region moves more freely in women than it does in man.

It has been supposed, indeed, to be the normal type of female breathing to use the upper part of the chest to the practical exclusion of the lower portion; and this type of breathing has been called clavicular, because it is carried on by that portion of the chest in the region of the clavicle or collar bone, while the male type, in which there is more action of the diaphragm and less of the upper chest, is called diaphragmatic. But a sufficient number of experiments by different observers have satisfied the writer that this so-called fe-

male type of breathing is not the intention of nature, but is the result of corset or other tight dressing, which prevents the natural use and development of the diaphragm. It is found that little girls who have never worn corsets breathe with the lower part of the lungs, and use their diaphragm as fully as do boys of the same age. We find too that with civilized women who have never worn corsets the diaphragmatic breathing is the type rather than the clavicular, while savage, Chinese, and gypsy women, who are guiltless of any waist constriction, show diaphragmatic breathing equally with the men of their tribes.

It has also been shown by Dr. Kellogg that while a woman who wears a corset does exhibit this clavicular type of breathing, making little use of her diaphragm, the same woman when she has dispensed with her corset learns gradually to practise diaphragmatic breathing with nearly the same freedom as a man; and finally, to demonstrate how a constricted waist must affect the diaphragm of any being, Kellogg shows that the breathing of a man in a corset is almost precisely like that of a corseted woman, — that is, of the clavicular type.

To ascertain in figures how much ordinarily tight clothing interferes with lung expansion and freedom of the diaphragm, the writer induced ten young ladies to allow themselves to be measured about the chest both with and without a corset or waist, and noted the results. The girth was taken about the ninth rib, or just below

the lower portion of the lungs, and where the diaphragmatic action is most visible. The average girth at this point was about 27.50 inches over a gauze shirt. One half of the girls generally wore corsets, the other five wore "reformed waists." These being put on, the same measurement was again taken over the corset or waist, when it was found to be from half an inch to an inch and a half *smaller* than without any clothing, in the case of the corseted girls; in those with the waists it was generally larger by one or more inches.

The chest expansion of all being taken at the same level without corsets, was found to amount to two and three inches; taken with the corset on, it averaged only three-quarters of an inch. One girl, who wore a low riding-corset however, expanded one and one half inches. Those who wore the reformed waists could expand from one and one half to two and one half inches. These figures point their own moral, and make comment needless. It is idle to hope for a perfect physique or fine development of the body when it is denied its first great right of fresh air and freedom; and to demand the amount of physical activity requisite for development of girls whose organs are strapped in, and whose supply of oxygen is curtailed by many inches, is cruelty.

Either physical development or tight clothing must go. But the effect of waist constriction is farther reaching than the lungs. The corset and all tight clothing

work their ill effects upon the abdominal and pelvic organs in quite as serious a manner.

There is, indeed, as we have seen, some compensation for restriction about the lower chest region in the exaggerated activity of the upper chest in women, but for the displacement and injuries to the abdominal and pelvic organs that occur from the same compression there can be no compensation.

The diaphragm has a most important influence upon these lower organs, because its office is not only to pump air into the lungs, but also to pump blood into the heart. For when the vacuum is created in the chest by inspiration, the blood from the abdominal and pelvic veins is sucked upward by aspiration into the chest, its naturally slow course being in that way accelerated and encouraged by every breath we draw. The fuller the inspiration the larger the vacuum formed in the chest, and the more profound the effect upon the circulation of the liver and stomach, the uterus, and all adjacent organs.

In estimating the value of deep inspiration upon the pelvic circulation one more fact should be noticed,— namely, that nature has not provided the same helps to the return circulation in the pelvis that are found elsewhere in the body. The blood in the lower extremities in returning to the heart is for the most part flowing against gravity; and in order to assist its upward course the veins are generally provided with tiny valves, which, like locks in

a canal, dam it up for a second's time that it may gain greater force and propelling power later. But the pelvic organs in women are not provided with these helps to circulation, so that with this lack, and with the fact that the erect position tends rather to promote stagnation of blood in these regions, there would seem to be reason why pelvic congestions might easily occur unless every help of nature's providing is used to prevent them. The relaxed abdominal and pelvic muscles of women tend to promote this congestion also, — partly because excess of blood may accumulate in such inactive muscles, and partly because the relaxed muscular fibres permit displacements of the pelvic organs.

All of this interference with the pelvic circulation greatly increases the chances of displacement which tight and heavy clothing inaugurates.

The liver is probably the first organ to suffer from corset pressure. Normally, this organ does not reach below the border of the ribs; but under corset constriction it is pushed inward and downward, — sometimes so compressed that the markings of the ribs are found upon its surface, — and displaced from one to three inches below its normal position. The pressure of so heavy an organ in turn displaces and pushes away the other contents of the abdominal cavity, so there is a constant downward pressure maintained upon all of these structures.

Now, the uterus, which in turn receives this pressure, is held in position by ligaments which act as mooring ropes to hold it in place. These are formed of muscular and other fibres, which are capable of stretching under pressure; and this stretching actually occurs when waist constriction is present, so that the ligaments no longer sustain the organ in its normal position.

In fact, the evils of the corset or other waist constriction appear to the writer to be as serious in their effects upon pelvic health as upon the chest region. Their influence is always recognized by intelligent physicians who are called upon to remedy these pelvic displacements, congestions, and allied difficulties, the lines of preventive and curative treatment always including rules for such dress as shall permit the free oscillations of the diaphragm as well as for exercises which shall cultivate the vigour and healthy tone of the abdominal and pelvic muscles and uterine supports.

Nothing has been said regarding the weight of clothing, because the application of the principles of freedom and non-constriction are so obviously applicable to excess of weight as to need no comment. Neither have the discomforts of tight dressing been enlarged upon, because they too are matters of common experience to most corset wearers, many of whom have been frank enough to confess to the writer that they were never comfortable in corsets and did not suppose any woman could

be, sadly bearing their yoke as part of their debt to civilization.

The limitation that corsets put upon the natural and graceful movements of the body, most of which depend upon the freedom of the spine and the waist muscles (as in bowing and bending, and all the side and rotating movements of the trunk), is certainly obvious enough to others, if not always to their wearer.

Some one with more force than elegance remarks, "Woman in stays cannot stoop, she must squat." The writer heard an unintentional commentary upon this text recently by one woman who half enviously said to another, who bent quickly and gracefully to lift an article from the floor, "You must wear a very loose corset." "I do not wear any," was the quiet rejoinder of the well dressed friend, who preferred a trifling addition to her waist to the awkward immobilization she had found in the conventional corset.

Indeed, to aspire to grace and flexibility and a fine development of the trunk, and still to cling to a tight corset, is like requiring activity in a bandaged arm, or looking for the sensitive and vital movements of life in a wooden leg.

Freedom, space, activity, — these are the necessary environments of the body if we would attain its fullest and most charming development. Fortunately, these are possible, and elegance is possible, by the use of the

well fitted waists, which are to be found in every city and town. The comfort and pliability of these waists have recommended them to hundreds of corset-lovers all over the country; and with them the introduction of light and well-supported other clothing, details for which can be learned in most of the same shops, offers in this respect the girl who honestly desires health, grace, and freedom to use her body, a hopeful and attractive future.

CHAPTER V.

THE INFLUENCE OF SCHOOL ON PHYSICAL DEVELOPMENT.

FULLY one half of every girl's waking hours are spent either at school or in study preparing for it, and so, approximately under the same conditions. If we admit a five-hour daily session, or the ordinary one from nine until two o'clock, we see by a little multiplying that a girl between the ages of nine and eighteen spends nine thousand hours in the schoolroom, adding a thousand more for each year after eighteen that she goes to school. It must be quite evident to any thoughtful person that the influence of such an amount of time for good or for evil upon the physical part of this girl's organism cannot be slight; and this is the more certain because these school influences are quite unvarying in their character, the physical advantages and disadvantages being fairly balanced in most schools, omitting the poorest grade, and at all periods, until perhaps the closing year or two of school-life, when the sifting of scholars brings

more space and air to the older classes, and sometimes a relaxation in discipline calls for less immobility.

Now, the text of this chapter will be based upon the conviction that school-life is responsible for much of the ill health of young girls (the case is practically the same for boys, only we are not here considering their needs), and for many of their physical deficiencies, asymmetries, and lesser deformities.

If those conditions of school-life which retard physical development were unavoidable evils, and indispensable to brain-training, it is probable that they would not be discussed here, because the necessity and value of mental training is so absolute, from every point of view, that one might feel called upon to sacrifice some small degree of physical development, if that were necessary, in order to attain it. As a matter of fact, most persons who lead a literary or other sedentary life are obliged to make this sacrifice; but most of the unfavourable conditions of school-life are so obviously avoidable, and the evils which result are so remediable (some of them being quite in the hands of the girls themselves, to correct or set aside) that they fairly come within the province of our subject.

It is quite true that the most crying evil of school-life, — namely, the impure air of schoolrooms, and their lack of ventilation, is not one that is within the province of the girls themselves to correct, although they could some-

times effect something in that direction if they were persuaded of the necessity of plenty of fresh air, both for physical and mental uses.

It was long ago established by scientists who have made studies of the elements of fresh air and of air that has once been breathed by human beings, that this re-breathed air is totally unfit for their use again. Observations upon the health of people whose ration of fresh air is small daily, show that re-breathed air has a poisonous effect upon them, — partly, of course, from its possessing certain gaseous and other elements, which represent the waste materials of the body thrown off by the lungs, and therefore never intended to be re-absorbed by the lungs in that same condition; partly, in a negative sense, because such air passing through the lungs has lost much of the oxygen which human beings require for growth and health; and partly because such "close" air is more liable to retain any germs of disease that may have been carried to it, and which would be dissipated by the admission of fresh currents of air.

Some of the invariable results that follow from breathing impure air are headaches, anemia, or an impoverished condition of the blood, in which the blood cells lack proper supply of oxygen, as well as iron and other elements, and dyspepsia, with the various discomforts and low state of strength that follow in the train of these disorders. Now, it is a noteworthy fact that

these and other affections, so common among school-girls, are rare under the age of eight or nine years. Children under that age rarely complain of headache, unless on the verge of illness; but after her school-days begin, dyspepsia, headaches, and anemia are some of the commonest affections that call for the attention of the family doctor, and by him are too often attributed to overstudy and mental strain.

We believe school-life to be largely responsible for these and kindred disorders of school-girls, — not, however, because their brains are overtaxed, but rather because the body is under-trained, and especially because it is robbed of its rightful supply of fresh air by confinement in ill-ventilated, or oftener not at all ventilated rooms.

There is a certain amount of space known as cubic space which every person requires in order to secure not only the first supply of pure air, but in order to obtain renewals of this air often enough to keep it pure without draughts. There is also a certain amount of fresh air that must come into this space every hour, so much for every person according to the age.

School-children require a cubic space of from two hundred and fifty to six hundred cubic feet per capita, depending upon their age; and the ventilation of the schoolroom should be such as to provide fifteen hundred cubic feet of fresh air every hour, per capita, and to entirely change the air of an occupied room at least

three times an hour, in order to maintain the proper standard of purity, — a room that is over-crowded needing even more frequent changes than this.

It is a fair statement that these conditions are never supplied in schoolrooms; for it is a startling fact that, notwithstanding these requirements of hygiene are known to be true, and that they are expressed with mathematical exactness in text-books and many popular treatises on the subject, our school-girls, whose parents are generally willing and able to supply them with the best conditions of life, do not actually receive as adequate an allowance of fresh air daily as do the criminals and lunatics in our best State institutions.

There are few schools indeed in this country that can offer any such proportion of fresh air per pupil as is offered by the most modern and best equipped of these charitable and penal institutions, which are for the sole purpose of sheltering lives that are more or less worthless to the State, while in our schoolrooms are being trained what we call the flower of our land; yet humanitarian principles have in many cases provided for these paupers and criminals the most approved and scientific system of ventilation, while these darlings of the prosperous go on poisoning their bodies and dulling their brains by breathing and rebreathing the scanty allowance of air that they find in the majority of schoolrooms.

This evil can only be remedied by the firmness and

intelligent co-operation of parents, who should refuse to send their children where the requisite provisions for ventilation do not exist, and through the intervention of Boards of Health, who should pass laws forbidding the use of rooms for school purposes which do not permit of proper ventilation, and which shall also limit the number of pupils to be allowed in rooms of given dimensions. But while it is true that parents and teachers and Boards of Health are the responsible persons in this matter, and that we must look to their intelligence and conscience to make laws that will remedy this evil, it is also true that in many ways the girls can often help themselves for the time being.

This can be done by assisting the ventilation of the room by opening windows and doors for even a few seconds or minutes, during changes between classes, and also by the pupils withdrawing from the main room during intermissions and moving about the building, the yard, or if possible out of doors, to gain for themselves a breath of air, as well as the desirable exercise.

One or two intelligent and sensible girls, by means well known to girls of tact and determination, can create among their fellows what is evidently a necessity, a public sentiment in favour of fresh air, — a sentiment which would realize that headaches and drowsiness and " nervousness " could often be dismissed by the opening of a schoolroom window or a brisk promenade in pure

air during recess, and that over-crowding and not over study is the cause of their ills. Some of the influences of school-life which are most unfavourable to physical development are however of a different nature, and are generally quite within the province of the school-girl to remedy. These are the influences of faulty positions and temporary distortions of the body seen at the school-desk, in writing or drawing or studying, sometimes in standing and sitting as well. These temporary distortions might be of small importance if only assumed for the moment; but where they constitute what we may almost call the normal pose of a school-girl, and where we realize that they are assumed by a most impressionable and easily moulded organism day after day and year after year for nine or ten years, it is impossible to doubt that they have a seriously unfavourable effect upon all of the structures included in the attitude.

The most important regions which, as we shall see, are liable to be retarded or distorted in their development by these school habits are the chest, or thorax, and the spinal column,— school attitudes tending to induce a flattened chest and a spine which is deviated either to the right or to the left of the vertical line, depending upon the direction of the attitude most often assumed. A familiar attitude often taken by girls at the school-desk is illlustrated by the accompanying photograph (Fig. 3) of a girl who was asked to assume the position most

common with her at school, upon which she dropped at once into the pose here represented. Undesirable as this is, it is actually not as distorted as the attitudes we not infrequently find school-girls assuming.

It will be evident that such a pose is not only unbeautiful, but may be positively deforming. We see how the shoulders are raised and drawn forward, so that the chest must be contracted and flattened, as can easily be demonstrated by assuming the position. Free respiration is impeded, partly because the diaphragm, which is the principal muscle of respiration, is cramped by this position, so that its free movements are limited; and the stomach and other organs of digestion are in like fashion squeezed together, and their circulation doubtless interfered with, — a matter of some moment after the hasty meals which generally precede the school-session. But after its effect in flattening the chest, perhaps its most apparent influence is upon the spinal column, in which all one-sided positions that are frequently assumed have the tendency to induce a lateral curvature.

In the case of our model it will be seen that this one-sided attitude, in which she is resting more upon the right than the left side, curves the spine toward the right in the upper or dorsal region, while there is a slight compensatory curve in the lumbar region. The right shoulder is somewhat elevated, and the right side of the chest becomes more prominent than the left, while the

FIG. 3. THE HABITUAL ATTITUDE OF A SCHOOL-GIRL AT HER DESK.

left side is made concave, and the left hip is thrown out and becomes more prominent than the right. These two defects — hollow chests and crooked spines — are in fact very common among school-girls; and like some of the diseases of children, they become vastly more common after the school-age than before. It is comparatively rare to find a child under seven or eight years of age with a lateral curvature of the spine, but between the ages of ten and eighteen these curvatures become extremely frequent. Out of several hundred young women and school children examined by the writer, from twenty-five to thirty per cent showed some degree of spinal curvature, varying all the way from an insignificant deviation easily recovered from by proper care, to a pronounced and permanent distortion. Almost all of those who were interrogated about their school habits acknowledged their school positions to be similar to or even more distorted than that of Fig. 3. Such positions are perhaps oftener taken in writing than at other times, although they are chronic in many cases; out of two hundred children whose attitudes in writing were examined by Schenck of Berlin, one hundred and sixty were found seated in a position to induce a curvature of the spine.

It must be understood that lateral curvature of the spine is not a disease, but a distortion, due to the lateral deviation of the spinal vertebræ from their normal verti-

cal axis, with the results (varying with the extent of the deviation) that must follow when this twisted structure is the central supporting column of the body and has many important relations to other structures.

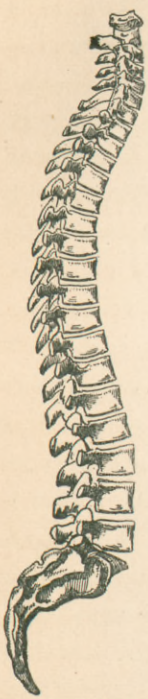


FIG. 4.—Side view of the normal Spinal Column.

It is upon the erectness, suppleness, and strength of the spinal column that most of the power and grace of the body depend; for it is impossible to imagine either one or the other of these qualities in a weak or distorted spine. The way in which these qualities are favoured by the structure of the spine we shall better understand if we glance at the illustration (Fig. 4), which represents a side view of the spinal column.

It will be seen from this view that the spine normally exhibits four curvatures, but all from before backward, not from side to side. One, in the neck, forward; one backward at the shoulders; the third forward again at the waist, or lumbar region; and the fourth, which is in the pelvis, sharply backward again. The object of these curvatures is to give a springiness to the spine which it would not exhibit if it were built like a straight rod; and this springiness is still further encour-

aged, as we shall see, by another provision. The entire column is composed of twenty-four separate stout bony bodies, which are rounded in front, and which terminate behind in spines, or projections (from which the column gains its name), which may be distinctly felt all the way down the back, and which, in a normal spine, are in a perfectly vertical line from neck to hips.

It will also be noticed that each of these vertebræ is cut off from its neighbour by a certain space, differing in size in the different localities. These spaces are filled by elastic cushions or pads of cartilaginous material, which, being quite compressible, aid in giving to the spine its elasticity, and which also add to the effect of the spinal curves in preventing the too severe transmission of a shock to the spinal column from a fall or other sudden jar.

The compressibility of these cushions is shown by the fact that we are taller early in the morning than at night, because the night's rest has permitted the cushions to regain the elasticity of which the body's weight had deprived them during the day. In severe lateral curvatures these elastic disks are compressed and thinned on the side of greatest bending and pressure, some of the vertebræ also being changed in shape, showing how permanently maintained distortions, even when they are not the result of disease, cause permanent internal changes which coincide with the external deformity.

On the sides of the vertebræ we may notice small half-moon depressions. Each of these, with that of its fellow above, forms a pit which receives the end of the rib, which is firmly held there by ligaments. A better idea of the attachment of the ribs may be obtained from the illustration of the thorax, given in the chapter on Dress.

All of the vertebræ are bound together by shorter or longer ligaments, which hold it strongly, but which permit considerable motion between the different bones; and the whole is connected and moved by longer or shorter bands of muscles, forming a structure wonderfully strong, pliable, and capable of most graceful and sinuous movements. These muscles and ligaments, being precisely alike on both sides, are intended to bear equally the strain of supporting the body; but when one-sided positions are habitually assumed, the muscles and ligaments which are constantly exercised upon that side tend to grow stronger and larger than their fellows, and these in turn will weaken and even waste away from disuse, so that such one-sidedness tends to perpetuate itself even when the position is changed, and a school habit, at first only nonchalently assumed, tends from natural causes to settle into a permanent attitude.

From what we know also of the relation of the ribs to the spine, we can see that anything that deviates these vertebræ sidewise or rotates them on their axes must

affect the ribs which are fastened to them. Now, as the ribs form the thorax in which are placed the heart and lungs, any influence which deforms or changes this cage may interfere with the functions of the organs it contains. Such an interference actually occurs in the more serious cases of curvature, producing shortness of breath, with heart and other functional disturbances. It is partly these considerations, which fortunately do not obtain in many cases, but which are in severe cases quite prominent, over and above those of its effect upon the symmetry of the body which gives special importance to this affection, and to any means for its prevention.

It should not be supposed that school-life is to be held responsible for the initiation of this affection; but there can be no doubt that to many girls its unfavourable influences, particularly those of steady confinement and faulty positions assumed for ease or through carelessness, prove to be the predisposing causes.

The precise and remote cause of spinal curvature is indeed still obscure. There appears to be a tendency to it in some which is absent in others, since two girls of the same age may be subjected to the same conditions, one of whom will exhibit the affection, while the other will escape. Exactly in what this tendency consists we do not know, although there are various theories about it; but the practical point is, that as it is impossible to tell which of any given number of girls may have this ten-

dency latent, all influences which favour its occurrence, — such as the ones already commented upon, as well as other bad attitudes, the carrying of heavy weights in childhood, absence of exercise and therefore a lack of muscular vigour, — should be carefully avoided, while all conditions favouring the development of the spinal ligaments and muscles in their natural relations should be courted by girls who desire health and a good figure.

Certain special exercises, which tend to cultivate the spinal muscles and their general suppleness, will be suggested later; but at present we shall point out two or three practical methods of remedying some of the present evils of school-life.

These remedies are two or three in number, and all simple, and easily applied. First, the conditions of school-study should be made comfortable for the girls by providing them with chairs and desks suitable to their height and development. These differences in height can be adjusted by variations in the chairs, changing the desks being more expensive, besides being more difficult in adjustment. The chair should be of such a height that the girl may rest her feet firmly and easily upon the floor, or upon a firm foot-rest, the seat being deep enough from before backward to accommodate about three fourths of the length of the thigh. Next, the back of the chair should be so curved as to support the spine

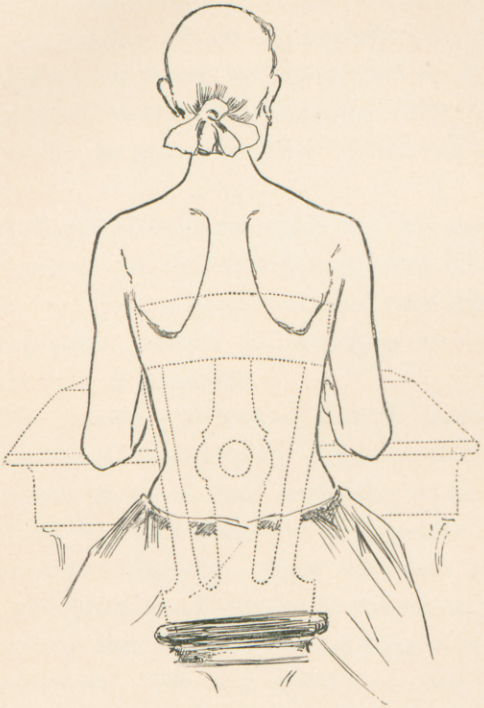


FIG. 5. THE CORRECT ATTITUDE AT THE DESK.

easily in its natural curves, both at the waist, or lumbar region, and also at the shoulder-blade level.

To fit the curves of the spine, chairs should be curved slightly forward at the waist region and backward at the point of the shoulder-blades, reaching just above their lower level. Chair and desk should be so close to one another that the student need not lean forward to read from books, which position tends to round the shoulders, and flatten the chest, and often to induce short-sightedness. If the desk and chair are properly arranged the girl can easily rest two thirds of her forearm upon the desk, without raising her shoulders by so doing. In writing, students should sit erect, with the body parallel with the horizontal axis of the desk, not twisted to one side or sitting upon one hip, as our first model is seated. The proper position at the desk is illustrated by Fig. 5, the feet resting easily upon the floor, and the back supported in the erect position by the chair. Writing should be taught and practised in this position, which will be found perfectly easy, if no other position has first been taught. The long confinement in the schoolroom may be made less irksome and its ill effects upon muscles practically obviated if two or three short intermissions of from five to ten minutes are given during the four or five hours session, and these utilized for muscular exercise and recreation. The trouble is that many girls use these periods of intermission for extra cramming of

lessons, while others are either too indolent to move their bodies when they have the opportunity or too ignorant of the necessity for so doing. A few brief but interesting series of exercises should be planned for these short intermissions which would give exercise to the arms and shoulders, a few bending movements for the waist and back, and some simple but brisk movements for the feet, which recreation would obviate the muscular weariness that follows immobility, and would greatly lessen the tendency of faulty positions temporarily assumed to settle into awkward or distorted figures.

Such a short series is actually given in several of our best schools in New York and elsewhere to the writer's knowledge, with great benefit to all concerned. Where they are not provided for, girls can easily improvise some active movements themselves, a few suggestions about which we shall give in another chapter.

The accompanying illustration (Fig. 6), taken from life, of a familiar attitude in standing will be recognized by girls probably in many cases as their own. The attitude was quickly assumed by a girl of fourteen who was asked to stand in the position habitual with her, upon which she immediately assumed the one here illustrated. Other girls standing near her remarked that this was their own habitual pose.

We know of course that it is often necessary to rest the body by changing the weight from both to one leg; and

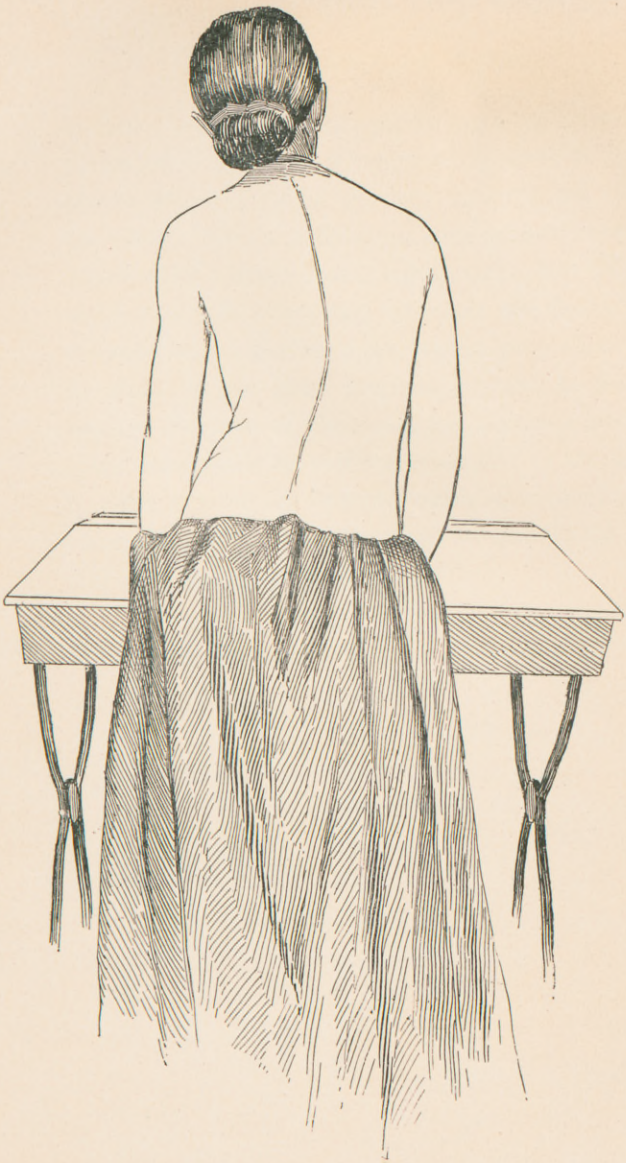


FIG. 6. HOW FAULTY ATTITUDES MAY TEND TO SPINAL CURVATURES.

in such a perfectly natural position there will be a temporary lateral curvature of the spine as there is in this picture, whose direction will vary with the leg chosen for resting. This actually is the case in many beautiful statues which are modelled in this attitude. The difficulty with school-girls is that they commonly rest always upon the same leg, so that when this leaning pose chances to be always in the same direction laterally, as the one taken at the desk or elsewhere, the tendency toward a spinal distortion is by so much increased. Care should be taken to avoid too frequent resting upon one leg, and where this habit is fixed, to change the pose to the other side when resting is necessary.

CHAPTER VI.

THE INFLUENCE OF EXERCISE ON DEVELOPMENT.

"WHY should it be necessary," asks one, "to preach exercise to every community in these days? Are we not the same flesh and blood as our fathers and our mothers who did not hear these sermons and were not obliged to know the reason why? Is not the instinct of the body guide enough for each one of us, so that we may rest in peace until we feel like moving, and then be permitted to move in the manner that best pleases us?" Possibly, friend, if our instincts were all educated and to be trusted; if our people lived more nearly the quiet lives of our ancestors; if our girls were all vigorous and had strong bones and fine chests and straight backs; if their muscles were the useful and active servants of their bodies that nature intended them to be, and not the relaxed structures that we oftener find them; if the American people did not need every offset possible to their eager and worried lives; and lastly, if it were not as rational and evidently necessary to educate the body as to educate the mind, then we might stop preaching from

this text. But until this millenium has come, the preaching must go on; and until we cease to be twenty-four hour clocks, we shall need the every-day winding up that can be found only in exercise.

It is a healthy sign that in this busy-brained country so much thought has been running in the direction of cultivating the body. To love physical activity, to revel in bodily freedom is the natural love of healthy childhood and the delight of a spirited boy or girl; and if mature manhood and fashionable young womanhood feel a pride in physical attainments, it is not wholly the remnants of a savage instinct that gives them this delight. It is a healthy sense of power, and the reflex upon the mind and the influence of a sound body that is of such inestimable value in the sports and athletics of the day.

To overestimate the importance of this physical activity upon bodily development is difficult. Serious indeed as are the unfavourable influences of dress and the limitations and confinement of school upon young girls, the evils of insufficient exercise upon their healthy development outweigh them all; for it seems to the writer that to this lack of proper exercise in girlhood and womanhood, with its resulting weak muscular system, and all that involves, we must attribute a large proportion of the ill health and much of the unsymmetrical development of the girls of our day.

The statement that the lack of exercise is responsible for the weak muscles of girls seems at first glance an unimportant one, and would certainly be so if it referred only to the size of muscles, and if muscular tissue could not be shown to be of immense importance in the body. Once for all, however, let us disclaim any interest in the development of huge muscles. Enormous muscles are not the aim and object of exercise, they are not what either men or women require for health, and certainly not for beauty. Such undue development is often only local, — as, for instance, the immense arm or over-developed shoulders of the athlete, — and does not necessarily mean fine health or symmetry. But by recalling two or three facts about the body we shall see how the weak muscular system of girls can be shown to necessitate a limitation of most of the great functions. For instance, weak muscles if they affect the heart may result in poor circulation; if they include the chest, there is insufficient respiratory power; if the stomach, some forms of indigestion follow, any one or all of which is capable of resulting in impoverished blood, in brain-tire, in overgrowth of fat in the body, and even in severe functional pain. In addition, with weak muscles follow relaxed support to the body, and so come stooping shoulders, the weak back, poor carriage and many other undesirable deficiencies that limit the development and beauty of a girl. These facts give to the muscular system greater importance

than it would at first sight appear to deserve, but observation and physiology bear out the important position it holds in the economy of the body.

There are two great channels through which the body accomplishes its will, either in work or play; these channels are the muscles and the nerves. The whole bony skeleton, strong and complete as it is, is useless without some power which will move it, and, except to an anatomist, is ugly except it is clothed. The moving power and the clothing alike are furnished principally by the muscles, of which over five hundred have been counted on the exterior of the body. These, as we know, have their activity initiated and controlled by the nerves; and it is when both of these channels are perfectly smooth and unobstructed, as one may say, that we get grace and control of the body so that we are able to use it in any desired direction.

It would seem evident that so large a part of the body as is represented by such a mass of material as these five hundred muscles, and which contains one fourth of all the blood in the body, must be intended to play an important part of some kind in the economy, and that the vigour or weakness of such a mass must seriously affect the rest of the organism; but upon looking closer into the body, we find that these five hundred external muscles by no means represent all the muscles of the body. On the contrary, the most important internal organs of

the body are either wholly or in part composed of muscles, and muscular fibres in greater or less profusion are distributed over most of the internal structures. The external muscles are what we call voluntary, and are under the immediate control of the will. They are somewhat different in their intimate structure from the internal muscles, but the function of both is the same, and the laws that govern their growth and their usefulness are identical.

We are familiar with the wide distribution of the external muscles. We know the large masses of muscles that move the thigh and leg, the shorter bundles in the shoulder region; we find tiny strips of muscle in the wings of the nose and in the eyelids; short bands that run between the ribs to raise and lower them in respiration; longer bands that bind together the spinal vertebræ and hold the back erect; numerous groups that permit the complex activities of the hand, — in fact, muscle, which is the lean meat of lower animals, covers the entire skeleton, and moves it at our will; and it is a fact that the growth of the skeleton itself is very dependent upon the amount of exercise or the number of muscular movements that the growing girl may indulge in.

These external muscles have a helpful way of storing in their recesses extra amounts of oxygen, over and above what they require for their own immediate use, which they keep as a reserve material against the

day of sudden or prolonged exertion and need, and this function they exercise over and above their contracting power.

But look at the wide distribution of muscle in the interior of the body. There is the heart, whose stout walls are all muscle, the incessant and vigorous contraction of which is the necessity of the body; there are many of the blood-vessels depending largely upon the muscular fibre contained in their walls to help along the blood-current. There is the entire digestive canal, whose structure is almost entirely composed of different coats of muscles; and upon the healthful activity of these muscular walls, which move about the food from place to place and bring it into contact with the digestive juices, depends the digestion and nourishment of the owner.

Muscular tissue also forms an important part of the respiratory apparatus, being found in the wind-pipe and small bronchial tubes, and even in the air-cells of the lungs, where they assist, by their contractions, the respiratory process. In the abdominal and pelvic organs, muscle takes a large part. It is well known that the uterus itself is a solid muscular organ; and, what is also of very practical importance, the ligaments that support and retain it in the pelvic cavity are also supplied with muscles upon which much of their tonic contraction depends. The floor of the pelvic cavity, upon whose tone

the normal position of the uterus depends, is also largely muscular; and the regions about this locality are generously supplied with muscular tissue, which gives it firmness and support. Muscular tissue is also present in the ovary, and elsewhere in the internal economy it may be found; but enough has been said to indicate its wide distribution and great importance.

The other channel through which the body accomplishes its will is the nerves. It is common knowledge that, in general terms, our external muscles move through our willing them to do so, and that the orders for work are transmitted to them by the nerves; but perhaps we less commonly think of another important office filled by the nervous system, without which our muscles, even in executing movements, would play us very droll tricks. This is the co-ordinating power exercised by the brain over our muscles, by which it gradually teaches them to execute a movement, as we say, correctly, — so harmonizing the different actions of the muscles called into play at one time that they do not each work for a different end, and so exhibit a motley disturbance (some fibres pulling up, some down, some in, some out), but all, after some education, tend smoothly to execute the one command. How the practice of different movements tends to educate muscles is very easily seen in the infant, who reaches eagerly but vainly for a gaudy toy, now striking out right, now left, now up, now down, but generally all in vain,

until the nerves of the eye and the others in control of the hand have together calculated the distance and harmonized the contractions of the necessary muscles so that they are just sufficient to reach and seize the desired object.

What is the reason that a boy who is learning to write finds it such a painful task, or that another climbing a tree for the first time presents such a bewildering confusion of sprawling legs and wiggling body? In technical language, it is because the boys have not learned to co-ordinate their muscular movements, — have not, in other words, practised the movement often enough to have made their nerves perfect channels which easily carry the brain's message to the muscles, — not letting some of it spread out into the by-paths of muscles unnecessary for use, but confining it exactly in the legitimate path. Now, this co-ordination is one of the most important results of exercise of any kind. The spine, for instance, is the pivotal point of the body. To maintain it erect is not so much a question of great strength of the spinal muscles, as of their proper equilibrium. If the right-side muscles pull more actively than the left, we are no longer erect; but when the power of both sides is in equilibrium, we are finely upright. The tight-rope dancer is a marvel, not because she has such enormously developed muscles in her spinal column which carries itself so perfectly, but because these muscles are equally developed

in power and activity, in absolute equilibrium, sensitive to orders and accurate in obeying them, and when they become otherwise, she falls at once. Indeed, the true secret of grace is dependent on this perfect equilibrium of the body. It means that we use those muscles, and those only, that are necessary for the movement; and this fine control, this perfect balance of muscular power and activity which we call co-ordination, may be gained for some one part by special training, but for the whole body only by general exercise. And so by this repeated movement the nerve is improving the muscle's strength, facility, and health; and the muscle, bringing fresh blood to nourish the parts and giving by its exertions fresh exercise to the nerves, is also improving the nerve power. The influence for good upon both is reciprocal and constant, and this influence is what we mean by training. This is the end and object of the practice of anything, — of ball-playing or tennis or swimming or croquet or walking, as in the case of the infant, who must learn to co-ordinate the right muscles before a step is possible. In each and all of these sports and exercises which call into use the functions of nerve and muscle, and therefore train them imperceptibly to themselves, we are all unpractised, or, as we say, awkward, until the nerve channels which carry the order and the muscle channels which execute it are both perfectly smooth to transmit and quick to respond.

CHAPTER VII.

SOME THINGS THAT EXERCISE WILL DO FOR THE BODY.

WHEN we ask what exercise can do for the human body we put into the word exercise a very definite meaning. We do not mean for instance the occasional walk that a girl may take on the beach, or the single riding or fencing or gymnasium lesson that she takes once or twice a month. The meaning of the word involves the idea of repeated practice, — something, whatever it may be, that we do once and again and again, possibly for pleasure only, but generally with the additional idea of perfecting ourselves in the practice. And it is only when these muscular movements are repeated and practised that we can dignify them by the name of exercise, or demand of them any results, either in skill or strength or agility or general bodily vigour. So we shall be understood here as speaking of the regular practice of muscular movements in some fashion or another, and muscular movements which, either through design or accident, bring into play a large part of the body, and do it systematically; for the need for repe-

tition is as necessary in educating the body as in training the mind. If we want to impress anything upon the brain, that thing has got to be repeated until the impression has sunk in; and if you want to make any definite impression upon these thousands of muscle fibres and train the co-ordinating power of all these nerve centres, and improve the conformation of the skeleton, and develop the capacity of all the organs, you will have to keep at it until the physical impression lightly made to-day, repeated to-morrow, has at last become an indelible memory, and the habit of the body. "What can you promise that systematic exercise will do for me?" asks a young girl of fifteen, seeking for some definite answer as to results. Well, it will simply make you more of a woman in every sense than you could possibly be without it. It will do this by improving every organ you use in movement; it will supple all your joints so that grace and ease will belong to them; it will make fatigue less frequent, and breathlessness uncommon; it will give you a bigger chest and more supple limbs and some force in your arms; it will clear away the fog in your brain, and the dyspepsia in your stomach, and bring you a rose for your cheek; and when your example has been followed by the girls of one or two more generations, it will give the world an idea what a noble creation a physically developed woman can be. Only it must be genuine exercise, and it must be systematic, otherwise the body will

forget its cunning, and the lesson will not have been learned.

The way that exercise can actually change the structures of the body, so that they will be different not only as to power, but to touch and appearance and intimate constitution, is well seen in an exercised muscle.

A muscle that is exercised has evidently been profoundly changed in its qualities, — its fibres have become firmer and harder; it has lost its superfluous fat; it is evidently less liable to fatigue than before its training; it does not suffer the pains common to unused muscles after exertion. It has become, in fact, not only a more enduring instrument, but one much more competent to execute our pleasure; it is swifter and more graceful because more exact in its execution of our commands. Exactly what has gone on in its interior we do not see, but we know by certain experiments that by its exertions it has helped to throw off waste products in the body, burning them up by its internal heat, and so helping to free the body of these hindrances, and that its activity has also quickened the circulation and the respiration, so that heart and lungs are engaged simultaneously in eliminating worn-out material and bringing new to refresh the body.

The feeling of fatigue from which delicate persons suffer greatly, after even slight exertion, is probably better endured by one who exercises constantly, because,

among other reasons, the nerve which supplies the muscle has become hardened by the repeated contractions of the muscle, so that its covering is rendered more resistant to pressure, and it becomes less sensitive to the buffetings of the muscle-bed in which it lies.

Since we see this process of improvement gradually going on in an external muscle under exercise, there is no reason why we should doubt that the same results are brought about in the internal organs and structures that we have learned are largely composed of muscle; and experience shows us that exercise does actually strengthen the muscle of the heart so that its contractions become more energetic with its increasing firmness of fibre, and it performs its work more vigorously, and at the same time more easily, than when it was less strong.

A soft and flabby heart muscle, such as sometimes occurs after a long illness, is indeed in no better condition to work wisely than is the rest of a convalescent's body, which is trembling with weakness, and unable to direct its steps. The nerves that should control such a heart are evidently sharers in its weakness, and so are unable to guide it with a steady hand. Tonics and nutrition are what these convalescents need for the body in general; and for girls as well as for their elders, exercise is the tonic that the heart requires in health, under which it gains the steady control and the muscular power that the body requires for perfect development.

Breathlessness, that disagreeable foe to exertion, is always lessened by exercise, for two or three reasons. In all unusual exertion the heart pumps blood so quickly to the lungs as oftentimes to embarrass them; being unaccustomed to the sudden demand for more air, they are confused, as we may say, and hardly know how to adjust their machinery to the demand. And besides that fact, they have been unaccustomed to make use of their whole territory, many of their air-cells being under ordinary circumstances quite unexpanded and idle. It is this confusion that we call breathlessness; and like similar unexpected incidents elsewhere in life, if we can only know of it beforehand we can be prepared for the emergency, and avert the confusion incident to the surprise. Now, exercise acts upon the lungs as moral training does upon the character, — gradually accustoming them to prepare for and meet the emergencies of sudden exertion with calmness; so that they really learn to breathe more deeply and more evenly under this efficient teacher, and to make less ado about it at the same time. The ascent of two stairs at once, to one accustomed to mount only one at a time, will at first make a girl "out of breath;" but constant repetition of the exercise will make it as easy to ascend two as one, while breathing with ease and comfort. So will a run down a gymnasium hall, or swinging of Indian clubs, mean breathlessness to one who tries it for a first time; but the ease with

which one in training can perform these trifling exercises, and many more considerable, shows how the lungs are trained by exercise to adjust themselves to work, so that they take in more breath and take it in more easily than before. The experience of mountain climbers corroborates this; and that is the secret of "training" in running, or other rapid exercises.

The joints are immensely improved by exercise; and this is a direction that needs cultivation and repays the training.

It is really upon the ease with which we move our joints that most of our grace and skill in movements depends. And perhaps some of the most noticeable regions of improvement through exercise are the joints. By movements they rapidly become more limber, more supple and easy in their movements. Piano-practice is a proof of the influence of constant exercise upon the joints in the hands and wrists, as well as an excellent one of what training will do to strengthen and educate muscles. The acrobat, too, and the contortionist show the result of constantly exercising the joints of the body, while ordinary gymnasium practice soon shows its results in the increased pliability of the shoulder and arm joints. The fluid that lubricates these regions is probably increased in quantity by exercise, so increasing the smoothness of their action; and we know, too, that constant exercise tends to delay the changes in the joints that come with

old age, when concretions form, and the fluid is apparently less in quantity, with the result that the joints become stiff, and are moved even with pain.

It is not a gracious thing to refer to the age of ladies, but it is well known that the most famous and charming women actors are no longer in their girlhood; yet who would fancy from the grace of motion and the supple attitudes, and the succession of rapid changes in position, involving sometimes the larger proportion of the important muscles and joints of the body, that these women were beyond their earliest youth. In fact these queens of the stage put to shame, in their physical accomplishments, the average girl of sixteen or twenty, and this by no means because they were born graceful and supple; on the contrary most of them have attained this skill through persistent exercise, carried on systematically for many years. In the sense of the bodily changes that mean old age, such people will remain young long beyond the natural period, and are generally physically fresh to the end.

The muscular structure of the uterus and the adjacent organs would lead us to the presumption that, like the heart, exercise might have a specific effect upon its development and its functions, and experience confirms this presumption.

It should be distinctly understood by girls that there are many forms of pelvic pain, especially in young girls,

which are attended by and are believed by physicians to be due to the lack of muscular development of these organs, to the fact that they have not really attained their normal size, and consequently they perform with difficulty functions which they were intended to perform with ease. The general weak muscular development found in many such girls, commonly accompanied as it is by a poor circulation and poor respiratory capacity, generally means that the muscular structure of the pelvic organs is similarly weak and unable to perform its duty. The poor respiration means an unoxygenated quality of blood. Not only is the heart muscle weak, but the nerves which control the blood-vessels may be more or less paralyzed, so that they permit stagnation or congestion of the blood in this region, and hence may arise severe cramps and other distressing symptoms. It should be noticed that in such cases these symptoms do not arise from disease of the organs, but from non-development of its structure, the infantine organs not being equal to the functions of adult life. The beneficial effect of exercise upon these conditions is continually being shown by the fact that such girls during a course of systematic exercise, along with the development of other muscular structures, evidently develop the muscular fibre of the uterus so that it becomes competent for its function ; and by this means, and by the coincident improvement of their general and local

circulation, they may lose the habit of pain, generally forever. It is quite true that there is another class of such neuralgiac affections that owe their origin to actual disease; but the more frequent and therefore the most encouraging class of cases among young girls is this variety that is evidently due to a failure in development, and which only adds a new argument for that physical education which shall result in the complete development of a girl.

The effects demonstrated by exercise upon the digestive canal, composed, as that is, so largely of muscular fibre, are very evident. Anything that develops the natural powers of organs improves their structure. Since digestion depends partly upon the movements of food all about the stomach, which are effected by its muscular coats, and intestinal digestion also partly upon the vigour of the muscular coats of that canal, we can readily believe that a better digestion and more regularity of the intestinal functions, and consequently better health and vigour will follow strengthening of this muscular structure. Practically we find this true, dyspepsia and constipation being often relieved by the prescription of muscular exertion when medicine has failed.

Exercise will also undoubtedly reduce fat in the body. While a certain amount of this tissue is indispensable, and many girls need more instead of less, many individuals suffer from an excess, which is really undesirable for

various reasons. Such excess is a dead weight upon the body. Now, it appears to be so partly from its actual mechanical weight, and partly because it absorbs a large quantity of oxygen which would otherwise go to support more useful parts of the body, so that very stout persons easily become breathless because the supply of oxygen which should belong to the body in general is largely appropriated for the benefit of adipose tissue alone. Exercise reduces fat evidently by increasing perspiration, which subtracts water from the fatty tissue, and also by increasing the combustion and destruction of its constituents.

So through all the different machinery of the body we can trace the benefits of regular exercise in invigorating and developing organs and making their working power greater and easier; and we can see how we have by exercise really improved upon ourselves as we came from nature (not as we were intended to come, however), and have, seeing the changes that we can effect at will in this way, demonstrated to ourselves once more that heredity, powerful as it is, is by no means all powerful and conclusive.

Suppose we look for a moment at the record of "gains" that can be shown in a girl's gymnasium. It is not a small thing that a young woman should have all of her body machinery so improved and stimulated to growth by twelve months' practice in a gymnasium that

she should add two inches to her narrow chest, the same to her stature, and increase her lung capacity by thirty per cent. It is not unimportant, when we remember the small strength of her arms when she entered, and how tired her back, that she should find many of her strength tests doubled in actual figures, and that she can look with a pardonable pride upon the erect spine and the vigorous arm that she has gained for herself in these few months, while the consciousness of controlling her body instead of having it control her, the knowledge that skill and agility and courage and a dozen other longed-for qualities have come to her through these few months of systematic but pleasurable practice, make the benefits of exercise seem very real to her, and to many others such as she. For this is not a fancy sketch, but has been repeated once and once again within the writer's knowledge, and I doubt not is being happily repeated in every well-organized gymnasium in the land, where the city girl is having an opportunity to recover her birthright.

Figures have been printed in every recent book that has been written upon any one's experience in the direction of physical training, to prove what wonderful gains can be made in a few weeks or months of systematic exercise. It is nothing unusual to find much more startling records than the simple case that has just been quoted. Every one of experience knows that a chest

can be developed, and arms can be increased in size, and backs can be strengthened and straightened, and muscular strength even trebled. But once more, desirable as these things are, it must be remembered that they are only the external signs and token of the many complex changes for good that have been simultaneously going on within the body, by which the whole economy has been stimulated to better growth, quicker life, and higher activity, improving its chances for life and doubling its capacity for enjoyment.

These results of exercise prove its importance for the adult and the mature as well as for the child and the young girl who has yet to perfect her physical powers; they help to persuade us that even after physical training has helped to develop us in youth there is still a large sphere for it in maintaining the good work it has begun, so that exercise is part of the privilege of the mature young woman as well as of the undeveloped girl.

CHAPTER VIII.

THE WAYS AND MEANS FOR EXERCISE.

THAT we should be obliged to sit down and seriously consider how our girls can find sufficient exercise to promote their development and to gratify their natural love for physical sport is a commentary upon our distance from nature. Fancy a gypsy mother or an Italian peasant devising a "system" for developing the muscles and bones of their hearty offspring!

The gypsy, it is true, gives her baby a species of massage, with frequent baths and rubbings, and plenty of exposure to the sun; but her list is a simple one, and very like Dame Nature's own nursing. While the system of the Italian peasant, who herself is perhaps driving her mule or bringing wood, consists in putting the little girl to goat-tending, where she can develop sturdy legs in running after the household stock, until later, she too may rise to the dignity of mule-driving or crop-tending, or kindred offices performed for the benefit of the masculine member of the household.

But the march of civilization and the inrush of emigrants have long ago made field-labour, and in fact much

of any so-called manual labour, an unknown factor in the life of the American girl, — even in the humbler walks of life, making buttons or polishing pin-points having long ago taken the place of hay-making or reaping in our free country; and this curtailing of out-door life, which gives bodily exercise in what we call the "natural" way, has increased with schools and social culture and conventionalities until it has become for the average girl a serious question as to how she may regain some of that physical activity which in primitive life is the price paid for existence.

When objectors decry to-day, as they constantly do, any "systems" of exercise, they must remember that the place is America, with its climate and its national temperament, variable, nervous, active, and that the time is now, not in idyllic days when Maud Mullers, spent whole mornings in the hay-field or Grace Darlings lived conveniently near to a row-boat, but when school-life absorbs most of a young girl's vitality, and society (even for the tiniest) what remnant remains, and that there are no hay-fields convenient to most cities, and row-boats are useless when the river is frozen, while horses and riding are not for the moderate many. Still the muscles cry out for activity, and the nerves play their pranks in sheer desperation; and our girls are often thin-limbed and hollow-chested, and in a word lack robustness. But civilization has come to stay; and we must meet

its evils with its advantages, and invent a way for this as for other American needs, by which the necessities can be satisfied.

What has it left us, then, for use and for pleasure in the line of physical activities for girls? And what is the attraction and the value of these employments? So short is the summer season of out-of-doors life that the sports peculiar to it are necessarily limited as means either for constant pleasure or development. Yet we must herald the popularity of tennis and archery and (girls') cricket as exercises which fill the demand for pleasurable activity in the open air, with plenty of exercise that is for the most part unobjectionable. It is the opinion of some physicians that tennis offers too violent exercise for the majority of girls, and that it can be held responsible for many serious pelvic difficulties that would never have occurred without it; and there is no reason to doubt that accidents, possibly otherwise avoidable, have occurred in some cases after imprudent devotion to the game.

But in most of these tennis victims inquiry will often reveal the fact that the tendency to these complaints pre-existed with, probably, a weak muscular system, and was only manifested, as is natural, after imprudence in this exercise; and second, that these girls often played in most unhygienic costume, — the tight corset fitting snugly around a figure that required perfect freedom and space

in order to make the rapid and energetic movements sometimes required, without strain or undue pressure. All that has been said about the corset with its pernicious downward pressure and constriction of chest space applies with double force to its use under these circumstances, the design of the tennis costume itself being sufficient evidence of the style that is held to be correct and comfortable. Played in any other than a loose and light dress its tendency might be considered hurtful, played in excess it deserves the same reprobation that immoderation of all kinds should receive; and as it is very active exercise, it should not be indulged in by those who have pelvic difficulties of a nature to be harmed by such exercise. Such girls should receive the advice of their physician before attempting it. It is quite evident that in this, or any other active game, a girl should use some discretion in estimating her own powers. One who has never been accustomed to much muscular exercise, and whose muscles are consequently relaxed and weak, would far better strengthen her muscular system first by gentler methods, developing their supporting and resisting qualities by degrees, after which this more vigorous exercise would be only pleasure, instead of an actual pain or possibly even detriment. (The caution applies equally to all new games which may be introduced by fashion or chance to persons whose previous muscular education and capacity are entirely unprepared

for them.) The general body exercise obtained through this game is so much more comprehensive than that afforded by most sports enjoyed by girls that it would certainly be desirable that moderation and personal discretion should so guide as to make it possible to popularize it everywhere.

In its call upon the legs for activity, its exercise for the hand and eye in aiming and placing the ball, in the demand for agility and skill, it offers most of the qualities required both for pleasurable activity and for bodily training. It has in common with most other sports the *one-armed* element, which prevents its being the absolutely perfect exercise for the entire body that we could desire, — for the ideal exercise is that which calls in play every member of the body, and gives harmonious activity to all.

Of all the out-door sports swimming is the only one which answers this requirement, — and this is an exercise which for pleasure, activity, and health, and for its almost perfect balance of bodily powers, should receive more attention from girls, and become a part of their physical education. The loose dress and the contact with nature, the absolute freedom of limb and the expansion of chest and extension and support of the spine, combined with the zest of a daring accomplishment, make it one of the most perfect and desirable of exercises for girls. It has the drawback of being for the most part possible only

during a very short season of the year; but we must seize the goods the gods allow in this respect, and the courage and vigour and development that are gained through the short summer season may prove the roots of larger growth, and are certainly useful in forming the taste for activity and physical freedom which once it is embued is a life-long possession of priceless value.

With the water comes the rower, and rowing can be recommended for almost all girls of any size who are strong enough to handle even one oar. The one arm gains steadiness with practice, and when two are used there is plenty of exercise for the back and the legs, and a certain steadiness and pliability gained at the waist that help to strengthen these generally undeveloped muscles of a girl.

Archery, which stretches the arm and chest muscles well and trains the eye to precision, and cricket, which has not become a well-naturalized game for girls as yet in our country, but which even when badly played offers plenty of exercise for arms and legs and heart and lungs, may help to swell the list of the out-door sports; and every one is an accession, for the girls' list is always too small.

Skating, like walking, is an exercise which makes large demands upon the lower part of the body principally, although the bracing air and the exhilarating sport are a tonic to the heart and stimulate respiration.

Not less exhilarating, and oftener obtainable, is riding, — an accomplishment which with all nations has held something of the repute it sustained with the Persians, who required of their sons only to ride, to shoot, and to speak the truth.

Although much less easy for women than for men, with their more constrained position, and too often fashionably restricted dress, we must allow that with all its limitations it is an exercise most wholesome and desirable. Young girls with tendencies to crooked spines may find it sometimes increases that difficulty, and those with pronounced deviations may be obliged to relinquish it temporarily. In some cases changing the saddle to the other side will relieve the tendency to one-sidedness, and many women habitually use two saddles to prevent any such danger. But this tendency aside, it is an exercise which takes one so continuously and joyously into the open air, and its activity is so fraught with helpful results to the digestive, thoracic, and abdominal organs, that, especially in cities where exercise is so difficult to obtain as an unmixed good, it should be warmly recommended.

But the summer months are only three in number, the streams become frozen in time, the snow covers the tennis ground, and even riding with a great coat becomes impossible. Where, then, shall the girls seek the daily bread which comes to their bodies through exercise?

There are days of snow and rain, when even walking is a burden, and, perhaps unfortunately, when the younger children are not allowed to try their fortunes in the parks or even on the sidewalk. Still the muscles cry for activity, and the bad tempers of the little ones, and the nervous irritability of their elders, and the returning headaches that summer's air and exercise had dissipated are upon them, and the girls do not know that the best prescription that their doctor could leave them would be an hour's shaking up in a well-aired gymnasium with dumb-bells for medicine; for we believe the well-appointed, carefully supervised gymnasium is to be the answer to the general call for opportunities for exercise in our cities. The life of a small country town or village or suburb offers out-door sports through the entire winter that are totally inaccessible to the city girl. Coasting and skating, sleigh-riding, tramps in the snow, and games on the spacious playgrounds may suffice if they are taken advantage of, for the dwellers out of town, although even there the schools need to introduce some muscular exercises into their curriculum, and parents cannot afford to entirely neglect the physical education of their children at home; but the average city girl or young woman has actually no resource in the direction of exercise during the winter months except a walk or a dance. Riding and driving are limited to the comparatively few, and even then, as we have seen, are

not possible in a large proportion of the days of winter. Walking is generally, but not always, possible. The day is lowering, or the object is lacking, and the exercise is neglected. In fact there are some reasons why walking is less useful for an all-round exercise for girls than gymnasium practice, although it has the great advantage of taking them out to seek their own oxygen first hand. But the aversion of whole boarding-schools full of girls to their hour's promenade, albeit the days may be fine and their company tolerable, shows how needful is some allurement, some object ahead, be it only, as one humourist suggests, a confectioner's shop, to give zest to this exercise, which in itself has little variety. "A real fur cape" says our same T. W. H. "may be counted as good for three miles," or any other innocent inducement for being abroad.

For walking one should have time in abundance (for every girl requires an amount of daily exercise not to be gained by less than a two to four mile walk), besides an object, and not too much immobility in the pose. Even then the muscles of the chest get little movement, and those of the abdomen and spine even less; and actual movement and activity are what we must furnish if we are developing chests and beautifying bodies in nature's way.

If our American girls could be trained in walking as we hear their duskier sisters in warmer climates are trained,

the exercise would indeed bring elasticity and vigour and endurance; but here again civilization interferes. These lemon-coloured girls of the West Indies, who "have figures to make you dream of Atalanta," begin at the age of five to carry small articles on their heads as they walk, a bowl of rice, a decanter full of water, an orange on a plate, — something that will compel an erect attitude and a steady pose of the head. These children are destined to become the *porteuses* of the island, carrying bread and fruit supplies far into the interior. When one of these is nine or ten she can carry a basket weighing from twenty to thirty pounds, and walks perhaps twelve miles a day, always bare-foot. At sixteen or seventeen she is a tall, robust girl, lithe, vigorous, carrying her tray weighing from one hundred pounds and upward, and traversing a daily route varying from thirty to fifty miles a day. With this wonderful specimen of what training will do, we may believe there is not a muscle unexercised in her body. The object, which with her is a necessity, the time, the freedom of movement, and the regularity of exercise are all present in this case, and the result is this specimen of litheness and vigour which for general physical perfection is the wonder and delight of travellers. One reason why walking is not the complete exercise it should be for girls lies in just this secret of lack of time. Mary Lamb and Miss Wordsworth could still walk their fifteen miles per day when they were nearing sixty, while few of our

city girls can walk a daily ten miles at twenty; but Mary Lamb and her friend had leisure for this exercise, and were not limited to the one, or at most two hours, that are allotted for out-door diversion in town life.

Wherefore, since the time for exercise is somewhat limited, there is the more reason for increasing the variety. So let the girls ride and drive and play tennis and row and swim and learn every sport possible out of doors, both winter and summer, but do not imagine that three months of this treatment will suffice to cure the ills of the other nine, nor lay the flattering unction to your soul that in an hour's graceful saunter down the avenue with her hands in a muff and her figure in a corset your young daughter will develop into that picture of ideal health and symmetry and physical perfection which you would fondly see.

She will get more general exercise in the ideal gymnasium in an hour, more life in her blood and colour in her cheek and strength in her limbs, than these city walks can give her in a week. Keep up the walking but cultivate a better style, and add the gymnasium practice to it at least three times per week. Provide a room of ample size, thoroughly lighted and ventilated, and with cleanliness absolute. The apparatus should be suited to two or three different ages and strength. Heavy dumb-bells and phenomenal Indian clubs are unnecessary, and generally deforming. Both bells and clubs should only

vary between one and two pounds, — the former giving the best results for the majority. Ladders and ropes are as good for a girl as for a boy, to whose early education they are considered indispensable, and are fraught with no more danger to one than to the other. By twisting and pirouetting, swinging clubs and shouldering bells and balancing wands in an easy costume with skilful and intelligent instruction from teachers who understand the mechanism and the capacity of the human body, the girls will develop chest and arms and heart and lung power as it cannot be developed under the conditions of city life elsewhere.

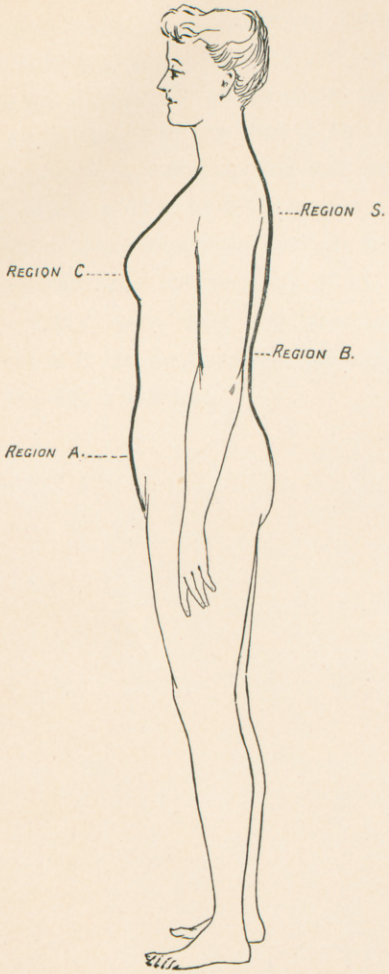


FIG. 7.

CHAPTER IX.

PRACTICAL SUGGESTIONS.

IN the well conducted gymnasium for girls, personal instruction, either in class or in private drill, anticipates individual need, so that the pupil learns not only the variety of exercises calculated to improve and develop womankind in general, but the special order that will improve herself in particular. But as many who desire to exercise systematically do not have gymnasium advantages, and many who have them have not learned to fit the exercise to the need, we shall offer a few suggestions in this chapter as to the regions which most require exercise in girls, and some details as to how they may be improved. The accompanying figure (Fig. 7) represents in her darker outlines the regions in which the majority of girls need special muscular development. It will be noticed that the dark line is principally confined to the region of the trunk. This has been done, not because the muscles of the legs do not also require regular exercise, but rather because with the majority of girls dancing and walking have already fairly

developed this part of the body, which is much less deficient than the upper region.

This figure represents in a general way our experience as to the actual deficiencies existing in the development of girls, and the regions where they most require development and muscular vigour, both for its influence upon internal organs and for the prevention of possible deformities, as well as for the cultivation of that balance and bodily self-possession that give erectness and harmony to the figure. The important relations these regions bear to health as well as to physical beauty have already been touched upon in the chapters on School-Life and Dress, as well as elsewhere.

No attempt will be made to give any long series of exercises for these different regions, but only to suggest a few that may easily be carried out either at home or in the gymnasium, with or without apparatus, which will themselves be suggestive of additional simple and complex movements which the pupil can improvise herself.

It is not the variety or complexity of the exercises that necessarily work changes in the body, although both of these qualities have their place in systematic training, but rather their application to the needs and ability of the individual and her persistence in their use. Miracles cannot be worked by desultory practice, but many remarkable and desirable changes in the figure and in the organs of the body can be brought about by degrees.

Medical gymnastics will not be touched upon in this chapter, as the subject involves too many considerations to be included here. Indeed, the best hope of physical training, is to anticipate the need for medicine. "The wise for cure on exercise depend."

Let us first consider how we may improve Region C, which, as we see, includes the upper chest region and the front shoulder muscles, as well as the bust, and is concerned, therefore, with arm development, because genuine arm-exercise always influences this region.

In all attempts to enlarge or develop the chest, however, we must work first from within outward. Our training should aim to increase the actual size of the lungs, or more properly to expand their unused portions, so that the motive power to increase may come from within.

When the lungs expand fully they press the ribs and the breast-bone outward, carrying, of course, the muscular walls of the chest with them; and consequently in an undeveloped person exercises that call for perfect and repeated lung expansion will inevitably tend to expand the chest, even if no special attention is given to its external muscular coverings. This is seen in singers as well as in some players upon some wind instruments, who are continually filling their lungs to the utmost, and whose chests are uniformly larger than those of a non-singing individual of the same age and general development.

Therefore, singing lessons under a scientific instructor offer one of the best methods for developing the chest in girls who have any vocal talent. If no such talent exists, at least every girl may have some lessons in voice culture, which, if given under a thoroughly competent teacher who understands the control of the larynx and the diaphragm will give her the vocal gymnastics which will assist development in the natural way.

Next, young children, and girls under fourteen who have flat chests should be encouraged to play skipping and hopping games, and girls over fourteen should train themselves in short distance and moderate running. "Why cultivate leg exercises," you naturally inquire, "when you wish to improve the chest?" Because the movements of such large masses of muscles as those of the legs and thighs demand large supplies of blood and consequent quick action on the part of the heart to supply it; and this blood pouring swiftly back to the lungs for purification requires frequent and deeper inspirations on their part to effect this purification. So the lungs are always stimulated to activity, as we have seen, by exercise, but more especially by exercises that call into play a large number of muscles at the same time. We see this in mountain climbing, where most of the muscles of the body are called into action, and we breathe deeply and often to supply this call for oxygen.

In running always begin slowly, running moderately,

FIG. 8.

for instance, fifty feet, then increase the speed gradually; but when running for exercise simply, *never* speed to the utmost, as this is not necessary for the benefits of the exercise. Always close the run with the same moderation with which it was commenced, — that is, never stop short, as this sudden arrest of action gives a most undesirable shock to the heart. The movement of running may easily be imitated in the house, while standing in one place, and simply lifting the feet in the same quick alternation from the floor.

Breathing exercises may also be practised with benefit. Lie on the floor, or flat on a couch, extend the arms upward over the head; take in as much breath as possible while counting twelve; hold it while counting five, and then slowly and gently expel it with an audible hissing sound through the teeth. This exercise can best be taken in the morning before rising, or when retiring at night, if exercising before breakfast is unpleasant.

Another breathing exercise which has some additional good effects upon the muscles of the sides of the waist may be taken according to Fig. 8. Raise the arms slowly from the sides to the position above the head, palms forward, inhaling deeply but gently while so doing; lower arms slowly to sides, palms still forward, while expelling the breath. This exercise is also well taken in a gymnasium by means of the piece of apparatus known as the chest developer. It may be taken once as a

breathing exercise, a second time without special attention to breathing, and the third time as a breathing exercise. Almost all movements that exercise the arms freely also assist chest development. This is because the chest muscles, after covering the chest wall in an expanded form, converge into a compact mass that passes over to the inside of the upper arm, and is inserted there, so that when we move the arm we are stretching and exercising these chest muscles also. For this reason, and because all free exercise promotes lung development, the arms should be freely thrown about, and the shoulder joints exercised every day.

The following circle exercise (Fig. 9) will be found to combine development for chest, shoulders, and arms also. It may be taken with one arm at a time, or with both together, or alternating first right, and then left. Taken with one arm it is more purely an arm exercise; with both it affords considerable exercise to the chest and shoulder muscles. Raise both arms from the side to highest position of figure, or until they reach an angle of about eighty degrees, thumb pointing backward, palms turned inward; then carry arms slowly backward and down, at the same time turning palm, so that the thumb, instead of pointing backward, points forward and down, and then backward and down as the arms describe the circle of the movement, coming to rest once more at the side, with palms in.

FIG. 9.

FIG. 10.

Another excellent arm movement, useful also for broadening shoulders, and stretching the chest muscles, is shown in Fig. 10. It may be taken with one-pound (or lighter) dumb-bells in the hand, or with a lightly weighted bean-bag, or without any apparatus.

Standing with feet together, stretch both arms horizontally outward, as far as possible, palms up. Bend the arm at elbow, bringing the palm back with a vigorous movement to the shoulder, resting the bell, if used, across the top of shoulder, as per figure. When the emphasis of this movement is given as above (that is, on the return to shoulder), the exercise brings the anterior muscles of the upper arm (and chest muscles) most into play, — namely, those which flex the arms, — and also gives exercise to the elbow-joint. It can be turned into an exercise for the back of the arm, where most girls are equally weak, by reversing the accent, — that is, starting from the shoulders, and vigorously extending the arms fully, the emphasis of the movement being in this case changed with the starting position. This may be used at first with one arm, then alternately, and finally with both together.

Thrusting with the arms is also excellent exercise, which can be taken without any apparatus. Clutch the hands, and bending the elbows, rest the hands on chest; then thrust the arm vigorously downward, then outward, then upward, half a dozen movements to each arm, with

vigorous thrusts in each, returning each time to the chest position. The movement is similar in effect to that of a washerwoman, or of a bread-maker kneading her dough, and in a gymnasium is carried on more vigorously by punching an inflated rubber bag; but neither wash-board, bread-board, nor rubber bag are convenient in the boudoir of the girl who may be reading these directions, but her arms and sufficient space she always has at command.

Exercise for Region S.

Round or stooping shoulders, with the muscles of that region, may be corrected, and the back of the arm also strengthened by the following exercise, which when taken correctly will be distinctly felt in these regions, as well as in stretching the chest muscles. The pose is not attractive, the first position of the arm resembling somewhat that of the bent wing of a dressed fowl as it lies close to the chest; but it will be found to be an effective exercise for the purpose. Standing with feet together, raise the arms, bent at the elbows, bringing the palms together in front of the face (See Fig. 11). Then with elbows still bent, swing both arms vigorously backward as far as possible, to a position even with the shoulders, both palms looking forward, as indicated by the dotted arm. The exercise should be repeated a number of times, the hands returning each time to position in front of face.

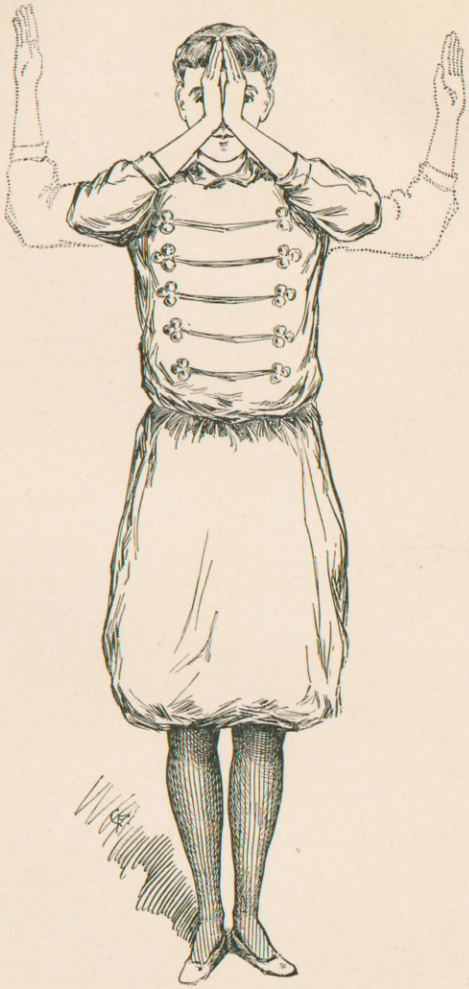


FIG. 11.

FIG. 12.

The simple swinging of the arms loosely in circles from the shoulder-joint, the alternate flexing and extending of fore-arm upon the arm, and the rotating movements of the wrist which are also beautifully cultivated by light club swinging, are excellent and simple methods of increasing the suppleness of these joints and the general freedom of these muscles. Club swinging is much more easily and satisfactorily learned in a few lessons from a teacher than from printed instructions; but those who cannot have such an opportunity of so learning can still cultivate grace and suppleness by these simple movements without apparatus. As a complex exercise that calls into play most of the muscles of the arm with those of the back of the shoulders, and that exercises the chest muscles, the lumbar and the leg region at the same time, the movement of Fig. 12 may be recommended. The illustration sufficiently explains the positions and the method. The pupil stands at first with feet together, and hands at side. The charge forward is then made, first with the right foot, the left being placed behind and at right angles, as shown in figure, the arms being brought forward, level with shoulder, palms in, from which position they are thrown backward as widely as possible (as per dotted line), and held in that position a moment, falling to the sides once more as the original erect attitude, with feet together, is resumed. The second charge should be made to the left, the hands and arms performing the same evolutions as before.

Region B.

All that we know of the functions of the spinal column, and all that we learn from observation of the deficiencies and weaknesses of girls show us how needful is the cultivation of its function as the central support of the body. For grace and suppleness of the body, its thirty-four joints should be constantly exercised, and all the muscles which hold it erect, which support the head upon it, and which in turn attach the shoulders and hips and arms and legs more or less closely to it, need varied and regular exercise.

Therefore, from childhood special attention should be given to developing this region of the body. It should be trained both for strength and for suppleness; and all the curious tricks of the contortionists, and the graceful and supple movements of the performers in a circus, show how training and exercise can develop the many powers of the spine. All movements that bend the head or the body backward, or that sway it from side to side, maintaining meanwhile its balance, or even that hold it perfectly erect, as in elegant walking, tend more or less to cultivate a greater or less number of the spinal muscles; but to reach all the long spinal muscles in its whole extent I know of nothing more searching and complete than the movement represented by Fig. 13, which in this case is given on a long bench,

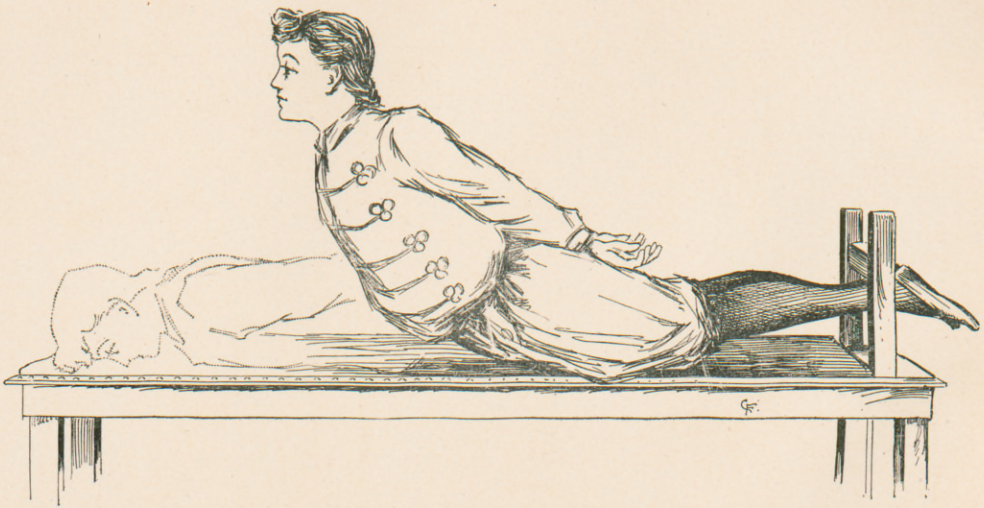


FIG. 13.

FIG. 14.

with a cross-bar to hold the feet, but which may be taken lying on a rug, or simply supported at the waist on a chair, the feet being caught under a lounge or dressing-case.

From the prone position, the feet being firmly held down, the hands clasped behind at the waist, the body is slowly raised and carried backward to the half-sitting pose shown in the plate, and then lowered once more to position.

In the case of girls or children whose shoulders are round or stooping, the hands may be clasped at the back of the neck. This movement may seem severe, or difficult; the illustration is however taken from life (the position being taken, in this case, by a young girl of fourteen), and can easily be accomplished by any one not an invalid or otherwise incapacitated. It should be taken slowly, and not more than three or four times at first.

Another excellent method of cultivating the spinal functions is by the simple movement represented in Fig. 14, which should be done with exactness to obtain the desired effect. Standing erect, feet together, rise upon toes, then sink the body to the ground, bending the knees until the thigh and leg are literally doubled upon each other. The trunk however must be maintained perfectly erect, the object of the exercise being to train the spinal muscles to perfect equilibrium, so

that the body shall not deviate a particle from the perpendicular.

The perfection of such graceful equilibrium is seen in the tight-rope dancer, whose attitudes in this respect might be partially imitated by girls in seeking the development of this region of the body. Young children might be trained to walk upon tip-toe with a lightly-loaded article upon the head, such as a tiny basket with iron jack-straws. The displacement of the irons would of course precipitate the basket, so that perfect balance of the head and all spinal muscles below it would be necessary.

Later, the experiment should be tried upon a wooden bar or log, still on tip-toe, with arms above the head, holding a light bar or cane. Such practice is represented in Fig. 15, and is perhaps most easily carried on in the gymnasium, but can also be attempted at home, — the delicate adjustment of spinal muscles that is necessary receiving in this way excellent exercise, and offering admirable training for an erect and graceful carriage. Movements similar to those performed by reapers or hewers may be imitated with or without dumb-bells, for the benefit of the sides of the waist and lumbar region. A reaper gets much exercise for his arms also at the same time. The reaping movement may be imitated by doubling one arm upon the chest, and extending the other outward as far as possible from the shoulder.

Fig. 15.

Bend slightly at the hips, and twist the body from side to side in stooping to wield an imaginary scythe. The arm positions should be alternated, — that is, contrary to the real reaping, it should be performed first with one and then with the other arm.

Region A.

The dark line, however, has not yet been exhausted, for there still remain exercises for the abdomen. The abdominal muscles are used first in bending, in stooping forward, somewhat in climbing, in raising ourselves from recumbent positions, and many other movements. Therefore any exercises taken in this position will favour their development. Abdominal exercises are also very useful in reducing the undue deposit of fat in this region, from which many suffer. Trunk bending, therefore, both forward and sideways, exercises these muscles; and although these may not appear very attractive, they are certainly very effectual movements. To practise them, stand in erect position and bend from the waist and hip (not from knees) forward, dropping the head easily as the body drops forward. Returning to position this movement should be repeated three or four times, when the side movement may be begun.

The side bending may be taken with one arm over the head, in the sidewise position, and when bending forward both arms may be raised and carried forward with the body.

These bending movements should be slowly practised; but the bending should be a genuine flexion of the trunk, not simply an inclination of the head or shoulders. Suppleness of the waist muscles will be still further obtained by gently swinging the body in a circle around an imaginary centre, the head dropping easily with the revolving trunk.

Another purely abdominal exercise is taken lying on a rug, the feet held down under a piece of furniture. The body is raised from a recumbent to the upright position without assistance from the arms, drawn only by the contraction of the muscles we are strengthening. This is an old "trick" among children, but none the less useful.

A more composite and active exercise that calls in play many other muscles besides those of the abdominal region, may be taken according to Fig. 16; consisting of a quick diagonal movement on the part of legs, called a "charge" in gymnasium parlance, and a sweeping bend of the body with arms outstretched to pick up a pair of dumb-bells from the floor. The bells secured, they should be held against the chest while resting; the body resumes its original upright position a moment, with feet together, when the charge may be renewed toward the opposite direction. It will be noticed that in charging to the right the right leg and foot are in advance, the body weight resting upon them, the knee slightly bent,

Fig. 16.

FIG. 17.

while the left foot is raised at the heel, the trunk, pliant and unresisting, bending at the waist.

Composite exercises such as these are very useful, not only because of their local effect upon a large number of muscles at one time, but because they necessitate co-ordination and supervision of these muscles by the nervous system which governs them ; and hence a composite exercise is admirable training for the nervous system, and improves its capacity to control the muscles themselves.

Two more complex exercises may be added which may be performed, the one with and the other without apparatus, and which involve exercise for many muscles, — notably the spine and the legs, as well as the arms, — but are given here more for their influence upon the abdominal circulation and adjacent regions.

Fig. 17 is taken without apparatus. First position: kneel on the left knee, the face looking straight forward, the right arm extended above head, the left at the waist. The head and entire trunk are then slowly turned to the left, the right arm following, this second position being the one shown in the figure. This is held for a moment, when the original pose is resumed. After three or four of these movements to the left side, the knee-position should be shifted to the other leg and the turning be made to the right. The effects of this simple exercise will be distinctly felt in the sides of the waist, the abdominal and groin muscles, and assist the circulation of these parts.

The second exercise (Fig. 18) is given with a chest weight, since these machines are, we are pleased to see, very commonly found in many houses.

The figure very well illustrates the position in which the handles of the chest weight are to be seized, after which the person rises to the upright, carrying the weights with her, returning again to the bent-leg position, and alternately raising and lowering the body in this way a dozen or more times. The weights should be light at first, perhaps only one (which equals two and a half pounds) being used; later, from five to ten pounds or more may be used, according to the ability of the person.

It would be an easy matter to add indefinitely to the number of these exercises, and to include in the selection many admirable movements that may be taken on machines specially adapted to develop each region of the body. Chest weights have become so common a piece of property, and each maker so enterprising with suggestions as to the use of his machine, that it seems unnecessary to add anything in this direction. That apparatus is useful, and often adds greatly to the interest of classes exercising, the writer knows, both from theory and from experience; but chest weights cannot always be found where books are read. Arms and legs and undeveloped bodies, however, may always be found; and where these are brought together, we would remind our

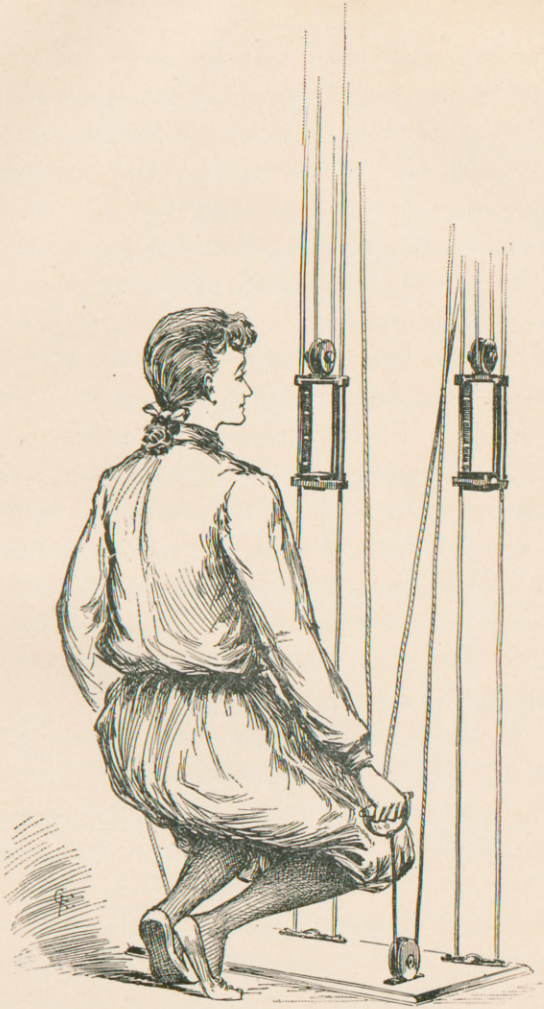


FIG. 18.

readers that development need never suffer because of the lack of a perfect gymnasium, desirable as the latter is for the complete physical training of young people.

Every girl who has a will to do it can improve the body she has, if it needs improvement, either in the line of strength and health, or of suppleness and ease, by persevering practice of even such a simple and incomplete list as here given, although we would once more remind the reader that the exercises here given are only suggestive of means by which she may accomplish much for her physical development.

As to the use of apparatus, one or two general cautions might not be out of place. Foreign books, or translations of the same, advise much heavier weights for the use of women and girls than is either customary or held desirable in America. It is the practice of the writer to recommend very light dumb-bells and clubs to all women, except a few highly advanced or otherwise exceptional pupils. A one-pound weight for both dumb-bell and club will be found sufficient for the average girl from twelve upward, and chest weights in proportion.

Most of the simpler exercises here suggested can be used with or without dumb-bells.

As to the amount of exercise necessary for health, it is estimated that a young woman of twenty should take exercise sufficient to be equal a walk of about five miles, daily ; but if much less distance than this can be accom-

plished, the required amount should be gained by home gymnastics or gymnasium practice. The best hour for vigorous persons is before breakfast; for the more delicate two hours after breakfast, or between four and five in the afternoon.

THE END.

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