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THE
GYMNASTIC PROGRESSION

BY

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THE GYMNASTIC PROGRESSION OF THE LING SYSTEM.*

MR. CHAIRMAN, LADIES AND GENTLEMEN :

In response to a request from the Secretary of the American Association for the Advancement of Physical Education to prepare for this fifth annual meeting a paper on the Theory of the Swedish gymnastics, I have the honor to present the following outlines of this theory.

The Swedish Gymnastics is a product of the renaissance of the gymnastics in the beginning of this century. It is the natural outcome of eighty years of development, the fruit of nearly a century of careful, continuous study. It is based upon the teachings of experience and is backed by well-grounded coöperative principles of Hygiene and Education. It had its first formal introduction in 1813 in a State institution at Stockholm, and its growth has been under the protection of the Swedish government. It has been strengthened by the coöperation of all the various

*An invitation from the Masters of the Public Schools of Boston called forth an informal address upon "The Gymnastic Progression of the Ling System" before the Superintendent and Masters of the Public Schools of Boston at their monthly meeting, held the 4th of March, 1890.

Later on this address was written and amplified by the author and upon request of the Secretary of the American Association for the Advancement of Physical Education, read before the fifth annual meeting of this Association at Huntington Hall, Boston, April 4th, 1890, and is given to the public in the following pages.

The author in the two and a half years that he has been laboring in behalf of the Ling system in New York, Brooklyn, Chautauqua, N. Y., and Boston, Mass., has repeatedly been asked the question "What is the Ling system?" This treatise may serve as a short, but comprehensive answer to this question.

It is the intention of the writer, if the interest in this subject continues to grow as hitherto, to offer in print a more extensive and detailed discussion of Swedish gymnastics in a demonstrative and systematic way, referring for description of the movements to the descriptive literature upon this subject in the English, German and Swedish languages. For the aid of those interested in the practical application of this system, the author has prepared a detailed plan for the direction of physical training in classrooms or gymnasia arranged upon the principles which he has advanced in this paper and which will appear in print in a few weeks.



departments of instruction throughout Sweden, where it is now incorporated as a regular branch of educational methods. Its gradual advance has met with various demands so that the present system has been reached along different lines which bear a distinct relation to each other intrinsically and historically.

The demand for a form of gymnastics arranged to meet an essential and general educational purpose and adaptable to existing educational institutions, has produced a method that forms the fundamental department of the gymnastics in our systematization of the subject. We call it the Pedagogical or Educational Gymnastics.

From the endeavor to extend the benefit that may be derived from a rational physical training to those who are below a certain average standard of health, has grown up a special branch of gymnastics called Medical Gymnastics. This discusses the modification of method necessary to be followed in training before the average health is reëstablished. This branch, although of more recent date, and an offspring of the educational gymnastics, has developed independently and reached a stage far beyond the expectation at its birth. Its present appearance suggests a future when it will be incorporated as an essential and indispensable branch of medical science, and through the orthopedic surgeons, the neurologists, and the gynecologists, it has already been introduced in medical practice. In its development it has created an impetus to a more scientific study of the mechanism and the effect of physical movements and the results gained have reacted beneficially upon the development of educational gymnastics and have contributed essentially to bring this branch up to its present scientific standard.

From a gymnastic point of view, medical gymnastics may be considered as preparatory to educational gymnastics. It leads up to it, just as the mildest form of educational gymnastics is preparatory to its more advanced stages and leads up to them.

On the other hand the desire to meet the demand for a more specific or higher physical accomplishment has led to the development of methods for more advanced work than that belonging to educational gymnastics proper. It has resulted in the branches of Military Gymnastics, Aesthetical Gymnastics and the various forms of Applied Gymnastics.

All the other branches being either in a measure preparatory to, or more advanced growths from, educational gymnastics

proper, I think it best suited to the purpose of this occasion to outline more completely the theory of the educational branch of Swedish gymnastics, and to let a mere suggestion of the systematic relations of the other branches suffice.

The functions of the heart and lungs are the fundamental functions of the body. Upon them the welfare of all the other functions depends. It is the aim of Swedish educational gymnastics to develop these fundamental functions and it endeavors to attain this end by a series of movements of the voluntary system which shall be so arranged and executed as to bring about a healthy response between the muscles and the will. It does not strive to develop physical specialists, but only to train the different organs of the body in a manner that may serve the great double purpose of promoting the efficiency of the circulatory and respiratory functions and of increasing the volitional control of the whole body.

Throughout its entire course the Swedish system of gymnastics proceeds upon the well-grounded theory that muscular strength must follow as the necessary consequence of a training so carried on as to promote the health and strength of these fundamental functions. Those who labor only to enrich the muscles often make piteous beggars of the heart and lungs. Theory and experience show that a system of training may be followed, which, while it develops muscular strength to a considerable degree, at the same time causes dilatation of the heart and lung-cells, consequently making their walls thinner and weaker. Upon such a training common sense stamps the seal of disapproval. Our clergymen proclaim to us the moral rule: "Get the heart right!" I would embody in the same words a physical rule: Get the heart right and the lungs right and the muscles will meet every reasonable demand. This is the teaching of experience.

Muscular work is resistance of muscular contraction. Such a resistance becomes a healthy training for the muscles concerned whenever they are furnished with a sufficient supply of well-oxygenated blood and a proper drainage of the waste products. Whoever would understand the systematic progression in training under Ling's gymnastics must keep this general idea always clearly in view.

Were the main object of physical training but to develop the strength of the muscles, then the systematic progression of exercises might be expressed by an ascending numerical scale, repre-

senting in pounds the resistance against the muscles. Were swiftness the aim, we could make our training conform to a progressive scale representing a certain number of oscillations in a given time, or if slowness were the object, by a similar retrogressive scale. Did we aim at complete control of the curvilinearity of the movements, we might symbolize the progression by a series of peripheral segments, or were angularity of movement the aim, we could resort to a series of angles. We find in many systems, and so-called systems, of gymnastics, present and past, one or the other of these points put forward as the governing object. The Ling system does not lay especial stress upon any of these points. It employs reduced as well as increased resistance, as the purpose may demand. It uses the swift and the slow movements for such effects as they can respectively produce. It embraces movements describing both curved lines and angles.

For a clear understanding of gymnastic progression we must bear in mind the general composition of the Swedish gymnastic drill, or what is termed a "gymnastic day's order." (*Gymnastisk dagöfning.*"—Swed.) "Gymnastic day's order" is a technical phrase that indicates something more than an ordinary space of time occupied in gymnastic exercises; it is the practical, distinctively formulated expression of a clearly comprehended idea, a practical application of a distinct hygienic and educational line of thought. The "Gymnastic day's order" must be adequate to the demands of each day's exercise within given limitations of space and time. It is composed of a certain number of movements succeeding each other in a well-defined order, calculated to produce certain effects in a certain succession, all these movements together being designed to bring about a distinct hygienic and educational result, which is the exponent of what we term gymnastic "unity" and "totality."

Hygienic and educational interests are interlaced with each other in the "gymnastic day's order," as may be seen by an analysis of its constituents. The hygienic line of thought in the "gymnastic day's order" is this: For a number of hours previous to their appearance in the gymnasium, or class-room for physical exercises, the pupils have had all their powers concentrated upon their lessons and recitations. Whether necessary or not they have been doing their work in a sitting posture, the chest more or less contracted, the upper part of the body leaning forward against the desk, the thorax bent forward and downward, press-

ing downward upon the abdominal organs and somewhat checking the venous circulation of these organs. This state of injurious muscular repose has continued for hours. As a consequence we have these results : A more or less temporary passive congestion, or tendency to such congestion, of the brain and abdominal organs, decreased respiration, the general tone of the muscles lowered, and the mind tired from prolonged concentration. The first object of the gymnastic drill must be to counteract these evils, to relieve the brain and the oppressed organs, to reinstate a healthy respiration and circulation ; to tone up the body generally, at the same time giving attention to the educational purpose of the exercises.

To accomplish this object we have first in the day's order a class of movements termed "*Order-movements*," intended especially to attract the minds of the pupils away from these lines of thought in which they have been so long occupied, to the approaching gymnastic work, to induce them to assume that fundamental position and carriage best suited to the physiological interests of the body, from which all correct gymnastic movements start and to which they return, before a relaxed position of rest is resumed.

Following this first class is a class called "*leg-movements*," intended to draw the blood in larger quantities down towards the lower extremities, thereby relieving the brain and the oppressed organs. These also stimulate the general circulation.

Next follow movements called "*strain-bending movements*" and "*heave movements*" which expand the chest and induce deeper and more energetic respiration.

The combined result of these four typical gymnastic movements in the order mentioned is this : More and better oxygenated blood is carried to the muscles and the venous drainage correspondingly facilitated ; the mind is relieved from its previous strain and the will is concentrated upon the muscular response. These results unite to form a most favorable general foundation upon which to ground the following more specific movements.

These succeed each other in the following order :

"*Balance-movements*," which bring about a coördination of muscular contraction in all parts of the body, and by demanding equilibrium in difficult positions, train the sense of correct and graceful posture.

"*Movements for the back*," which correct the carriage of the shoulder-blades and back, and, by equalizing the strength of the

muscles on both sides of the vertebral column, counteract the faulty growth of the spine.

"*Movements for abdomen and forepart of the body,*" which stimulate the abdominal organs by an alternating increase and decrease of the abdominal pressure. The movements strengthen the muscles of the abdominal walls, as do also the next following, called the "*alternate side movements.*" These last train the legitimate mobility of the ribs and vertebrae and mechanically stimulate the spinal nerves.

The movements mentioned above follow each other in the order named, and are performed with gradually increasing force, compelling stronger and stronger action from the circulatory and respiratory organs, but never exceeding a certain point, which I will term the *optimum*, the test of which is a deep, free, undisturbed respiration during the movement. This must never be pushed to the highest possible point, or to the point where breathlessness and uncomfortable heart-action begin to appear. Whenever the extreme limit is approached by any vigorous movements the effects are immediately moderated by administering movements that quiet and normalize respiration and heart-action.

By these movements the system is prepared for the next following: These are the more vigorous exercises of running and jumping, which bring about a compound action in all parts of the body, involving a high degree of exertion during a short space of time, approaching, but never exceeding the limit where breathlessness in its graver form sets in. Within this limit there is put the highest demand upon the heart and lungs and the climax of complication for training the coördination of muscular work is reached.

With these movements the culmination of the day's order is reached, after which the accelerated action of the heart must be normalized and the body prepared for rest. This is accomplished by slow, measured "*leg-movements,*" accompanied by deep, rhythmic breathing movements.

Interwoven with this hygienic line of thought is carried out an educational progressive idea in the same movements, which by their gradually increasing intricacy help towards a complete volitional control over the muscles of the body. Let us take jumping for an example. In jumping the greatest demand is put upon the heart and lungs. There, as in the advanced "*balance-movements,*" the complexity of the movement, if it be correctly per-

formed, demands a degree of exactness in muscular coördination that raises the volitional control of the muscles to the highest point. And so we find in each day's order expressed what we call a "gymnastic progression." But in the overlapping yet distinctive series which follow each other from day to day and from week to week and from month to month, and from year to year, each day's order should in a measure pave the way for the other more difficult and laborious ones that are to follow. To accomplish this there should be, as time advances, a gradually increasing demand for efficiency in the respiratory and circulatory functions, and also a constant demand for increased volitional control.

This general increase in the efficiency of the gymnastic day's order may be brought about by an increase in the number of single movements, or an increase in their laboriousness, or both. The increase in the number of movements must be subject to such restrictions that it shall not disturb the general purpose of the day's order. Within these restrictions, however, there is sufficient freedom to allow the teacher to bring his personality into the systematic work.

Between each of the movements in the day's order there is allowed a moment of complete relaxation, and the typical classes of movements already described are interspersed with a number of auxiliary movements which must be called into operation as a means of relief after the stronger movements by which the action of the heart and lungs has been greatly increased. But we must bear in mind that while the single movements should act together towards the great general aim of the day's order, they have also a specific purpose of their own, and the progression must be arranged with regard to both these points.

For example, the "*leg-movements*" while having their office in the service of the gymnastic day's order, help also to develop the muscles of the leg, to train the response of these muscles to the will, to check uncalled for coöperation of muscles that are anatomically and physiologically separate, to develop the muscular sense of the foot and leg with special reference to gait and firmness of position. And so the "*heave-movements*," while they widen the chest, develop the respiratory functions and induce deep breathing, have the additional effect of training the muscles of the shoulders and arms. And so on through all the single movements.

The efficiency of the single movements may be increased by a progressive increase of muscular resistance, that is, by increasing the labor which the working muscles have to perform within certain limitations ; or by gradually increasing the duration of the muscular work, or by gradually shortening the period for the same amount of work, or by increasing the frequency of repetition of the movements, or by increasing the complexity of the movement, that is by combining the same movement with more and more difficult positions, or combining the same position with more and more difficult movements, or by combining gradually more difficult positions with more and more difficult movements.

The increase of muscular resistance can be brought about in various ways. In Swedish institutions for medical gymnastics we make use of either manual resistance by another person, or machines especially devised for this purpose, are employed to resist muscular contraction. In the schools the aim is not a therapeutic one, but it is two-fold, hygienic and educational. We have to deal there not with individual patients but with classes of boys and girls representing a certain average standard of health and development. We must be prepared to direct at the same time, if need be, a class of two hundred persons or more. This is necessary not only for the sake of greater convenience, simplicity and economy, but for the all-important reason that the coöperation of many individuals brings to our aid certain educational principles of such intrinsic value that they may be considered indispensable.

The muscular resistance must of necessity be arranged in a somewhat modified form while working under these complications. Ling deduced this principle, in Swedish Educational Gymnastics to let one part of the body by its weight resist the muscular contraction in another part. Every active movement involves a certain amount of resistance. In the flexion of the elbow for instance, the muscles called into action have to overcome a resistance equal to the combined weight of all the segments of the arm from the elbow-joint to the last phalanges, multiplied by the imaginary lever from which this weight is suspended at the elbow-joint, and added to this product, the resistance made by the friction of the joint and the resistance made by the antagonistic muscles. Varying the position the amount of such resistance can be made greater or less by lengthening or shortening the

lever, or by changing the friction in the joint from assistive to resistive and *vice versa*.

This principle is followed out in the details of the arrangement and execution of these movements of the Swedish gymnastics. The apparatus used in Swedish gymnasia assists in bringing the body into varying positions that grade the amount of resistance to suit the purpose. For example, the resistance to the flexor muscles of the fore arm can be increased along a scale ranging from the amount of contraction needed to raise the fore-arm and hand to that required to lift the whole body. But whether the resistance be given by the hand of another person, by a machine, or by the leverage of another part of the body, the degree must always be commensurate with the individual conditions, and it should not be increased so as to call into operation the *maximum* or highest power of the pupil. The most favorable amount, or the *optimum*, is always somewhat lower, and the practical test for this *optimum*, as given by Ling, is that the movement must be performed with full, free breathing and with accuracy, that is to say without shaking or disturbing interference from other muscles. It is the purpose of the training to gradually raise the *optimum*.

Movements with even a lower resistance than that caused by the segments moved, are also used in Swedish gymnastics, indeed it may be reduced to nil and the movement be entirely passive. But these movements are made use of for certain purposes that do not fall within the field of educational gymnastics, but belong to medical gymnastics. The resistance employed in Ling's gymnastics, therefore, is graded between zero and the weight of the body, which for an average man would be equal to a pair of dumb-bells of one-hundred and fifty pounds weight together.

Finally, an important side of the gymnastic progression is expressed in the training of a number of pupils to *coöperate* in movements of a gradually increasing complexity, as illustrated in *marching evolutions*, *gymnastic games*, and *gymnastic dances*.

The marching evolutions demand of every pupil entire control of himself, that he may be able to move in correct pose through distinct lines and angles. The correctness and beauty of the evolution depend upon the close attention of each member of a line to the movements of the other members, and in striving to keep his movements in exact harmony with theirs, and his line in exact harmony with the other lines executing the same evolution. This complexity demands exact coördination of the func-

tions that regulate the movements. Furthermore upon the moral side it offers an entertaining variation from some of the other constituents of the gymnastic day's order.

In such movements as jumping for instance, each pupil works independently of the others and is to a certain extent permitted to yield to his natural desire to outstrip his companions. Freedom, independence, and competition, suggest themselves. But the pupils are allowed to indulge their desires in this respect only after their bodies, by foregoing preparatory work, have been made ready for, and worthy of, such more pleasurable and exciting trials, by compliance with all the requirements of the foregoing movements. We thus make one department of the day's order a prize for good work in the others.

In the marching evolutions there is still another lesson to be gained. It is a moral lesson that appeals to our sense of justice, teaching the mutual reverence and respect that are due to our fellow man. The marching evolutions demand for their success that every pupil, it matters not how superior he may be in individual competition, shall keep his shoulders in a line with his perhaps less fortunate brother, or sister. This suggests fraternity and interdependence for coöperative purpose, and mutual submission for joint benefit and common success. Let us not underestimate the value of this moral lesson interwoven with all the other benefits in the gymnastic day's order and suggested to the pupils throughout every day's gymnastic drill.

Gymnastic games are a form of applied gymnastics. They occupy, in relation to the gymnastic day's order, about the same place as running and jumping, although representing a more advanced stage. They have that in common with running and jumping that they bring about the joint efforts of all parts of the body, while the previous classes of movements in the gymnastic day's order, are all more or less localized upon a special part. But this generalization of the exertion is carried out in gymnastic games to an extent which in jumping is only vaguely suggested. In order to understand this clearly we must analyze these forms of exercises not alone from the physical but also from the psychical side.

All the movements which I have represented as constituents of the gymnastic day's order, from its beginning up to running and jumping, as also the movements that follow after jumping and

end the day's order, are executed in accordance with commands given by the leader of the exercise which demand close attention. The full significance of the words of command is not exactly understood by considering them as merely a means of simplifying the work. They can in a measure be compared to gymnastic apparatus, in its relation to gymnastic exercises. Gymnastic apparatus as I have already suggested, assists in localizing and grading the physical work. The words of command assist in bringing about a mental localization, or rather an intellectual passivity and direction of will-power towards the gymnastic exercises. They should obliterate all necessity for the pupil to occupy his intellectual force in deciding what is to be done, the teacher having that responsibility. His mental efforts should be spared so as to enable him to localize and concentrate all his volitional powers on the physical side throughout all the movements of this character. Any teacher knows that in drilling in language or mathematics, if there is to be success the volitional powers of the pupil must be localized and concentrated upon the mental side and that his attention must be directed towards the object of the teaching. It should not surprise us that in physical drill for educational purposes there is a parallel condition.

In gymnastic games, which presuppose a certain already acquired proficiency in physical culture, there is a more general distribution of the physical as well as mental work. There the rule of the game itself acts as the rigid disciplinarian who commands what shall be done and decides the exact time when it shall be done during all the varying chances of the game. But all these chances must be perceived and measured by every participant, and both the perception and the conclusion must be simultaneous, and the execution of what is wanted must be instantaneous; it may be a swift run or a swift ball or a swift and vigorous lunge. In short there is combined a demand for swiftness and exactness of mind with swiftness and vigor and exactness in coördination of the physical exertions. In addition they bring in the stimulus of mental excitement. It will be understood then, why from the standpoint of Ling's doctrines, educational gymnastics proper are considered as the basis and necessary preliminary for gymnastic games and other forms of applied gymnastics. In Sweden there exists a rich supply of old games that have for a long time been in vogue among the peasantry and that have a great fascination

for the youth. Still the whole branch of applied gymnastics has not yet received the same scientific elaboration as educational gymnastics proper, although great interest is manifested in that direction. Devotion to gymnastic games is encouraged as an advanced form of gymnastics.

In Sweden fencing is extensively made use of as representing the educational principles involved in gymnastic games. Fencing, whether it be with foils, broadsword, bayonet or dirk, demands swiftness and exactness of perception and judgment, swiftness and exactness of action ; in short, it demands in its highest form that mental and physical coöperation which I have represented as the most essential characteristics of gymnastic games when considered from an educational standpoint. In the hundredth part of a second sometimes is decided the fate of the lunge, or cut, and the success of the contestant depends upon his ability to seize instantly the opportunity offered. Fencing, like gymnastic games, adds the stimulus of mental excitement. But fencing differs from the most popular games in several essential points ; it does not require acres of ground for a small number of pupils, it does not require hours of continued practice, but can be graded off in fifteen minutes, in ten, or five, as circumstances demand. In short the amount of excitement and exertion can be easily measured to suit the purpose and it can be brought into a gymnastic day's order, preceded by movements that prepare for this compound exertion, and succeeded by movements that prepare for repose.

Gymnastic dances are another form of applied gymnastics. They have this in common with both jumping and gymnastic games that they bring about compound coördinate actions of all the parts of the body. But the difference is an essential one.

Like gymnastic games they differ from jumping by bringing higher mental functions into operation with the physical exertion. But the mental component in the dances is of an entirely different kind. It is not quick, clearly comprehended thoughts that regulate the movements. It is something vaguer, richer, and fuller, something more concrete, less distinct. The aesthetical perceptions, the emotions and sentiments, take command and the positions and movements of the body become their expression. The aesthetical moment being preëminent this form of applied gymnastics approaches the aesthetical gymnastics and perhaps ought

to occupy the same systematic relation to this branch as the gymnastic games do to educational gymnastics. I am obliged however, to confess that it is too soon yet to say much concerning gymnastic dances in connection with rational gymnastics. They have not yet received the scientific elaboration and finish that are necessary to prepare them for enrollment as a part of systematic gymnastics.

There exists however, even for this form of applied gymnastics an immense supply of rich material in the old Swedish folk-dances and this material has lately created an enthusiastic interest that promises well for the future. While I was a university student in Sweden there was a fresh movement among the young Swedes to rescue from oblivion the remains of a culture that had almost disappeared. Associations were formed among the students for the purpose of collecting from the peasantry the songs and tales, dances and games, that for so long a time have been the property of the people, and which have preserved through generations the characteristics of a peculiar culture. There is in those old dances an echo of that indestructible fresh good-temper and hardness of nature that form constituents of the old Swedish folk-character. It may give you an idea of some of these dances when I tell you that it is but about twenty-five years since, in certain provinces of the north of Sweden, a girl looked upon that man as inferior who could not kick twice his own height and in the dance lift her over his head while on his toes he moved his feet in time with the quick rhythm of the music, or who could not execute handsprings without losing a beat in the measure.

I spoke of music. The gymnastic dances are rhythmical. As already mentioned they do not call for intellectual reasoning. The movements must be done in harmony with aesthetical perceptions and sentiments, and this demands a certain amount of volitional relaxation. The movements must be those which by previous training have already become nearly automatic. It is only through this unmindfulness that they can meet the requirement of the aesthetical perceptions; and to those same aesthetical perceptions is the music applied. The music consequently assists on the physical side in bringing about volitional passivity, awakening the aesthetic receptivity and in conforming the movements to the perceptions, just as in educational gymnastics the word of command brings about the voli-

tional localization on the physical side and regulates the muscular work that shall be done in accord with the volitional impulses.

To one who has had the patience to follow this outline of the theory of Ling's system it will be obvious that in order to carry out a practical work in accord with its principles there is needed a detailed and thorough knowledge of the movements, their mechanism and reactions upon the body and mind. All structures of the human body must be studied in their relation to the movements, and all sciences that can throw any light upon the subject must be consulted. Normal and morbid anatomy, physiology, hygiene and therapeutics; natural, mental and moral philosophy, pedagogics, aesthetics, general and specific statistics,—all these have their share as auxiliaries when the subject of gymnastics is under consideration. Gymnastics is not a department of any other science. It is, and for the sake of its progress, it needs to be a cause in itself.

Only such movements are enrolled in the Swedish *materia gymnastica* as have a distinctly known effect, of such a character as to add value with reference to the gymnastic purposes which I have represented as embraced within the province of Swedish gymnastics. Ling's teachings are in discord with the adherents of the all-possibilities' theory, which advocates the practice of all movements that possibly can be performed, claiming that the very fact that a movement can be done proves sufficiently that it is beneficial to practice it. Ling made clear his standpoint on this question by the simple words: "We must not swallow everything that can possibly pass the throat." We select food according to dietic principles and taste, so we must discriminate between the movements which we enroll in our gymnastics. Many of the possible movements interest us only as material for our studies. Certain of them are selected, others rejected. In the first place, those are eliminated which are considered injurious, as for instance such movements as contract the chest, or those which produce a long-continued pressure upon large blood-vessels, or otherwise cause too long increase of local blood-pressure in some region of the vascular system, or those that produce such a pressure upon the larger nerves. All movements that have tendencies to produce faulty posture or deformities are properly discarded.

After selection upon such principles there still remain many which while harmless, are of no distinct gymnastic value, as for

instance, stretching of the tongue in different directions in accord with words of command. Such movements are left to the gymnastic pharmacopoeia of the all-possibilities' school.

After such a process of elimination there yet remains a sufficiently high number for allowing of infinite variety. If we begin to compute them we shall very soon reach figures that add thousands to thousands.

The selection of movements together with the gymnastic progression expressed in the gymnastic day's order, form together the characteristics of Ling's system.

Gymnastic movements however complicated are resolved, in the last instance, to some sixty elementary motions. Only a few gymnastic movements are the direct product of simple elementary motion in one joint. They are composed of two or more motions in several joints, and the most complicated are composed of a great number of elementary motions in nearly all the articulations, brought into coördinate action. It may not seem strange if I state that the number of such combinations is infinite. The whole infinite variety of things which we perceive by our senses is made up of less than seventy material elements. The combinations of these form the great material mass of the universe ; or, if I may be allowed another figure : In a language, all the words of the vocabulary are composed of a comparatively small number of elementary sounds, by the combination of which in different numbers and different relations, all the ideas can be expressed which together form the intellectual treasury of a people. The English language for instance is built up of less than seventy elementary sounds. By these there can be produced combinations in infinite manifoldness and variety. Out of this great mass only some one hundred thousand combinations have been selected of such character that they are adequate to suggest ideas to the mind and assist in their comprehension and expression. To these comparatively few combinations for the expression of ideas is due the powerful development of the Anglo-Saxon brain.

And so by the sixty elementary motions of the human body there can be produced combinations in infinite number. Out of this ocean of possibilities the Swedish educational gymnastics has selected those combinations which suggest gymnastic ideas and which help towards the fulfillment of gymnastic, hygienic, and educational purposes. Thus these movements form an arsenal of

physical agents or, if you will allow me to so express it, they place along side the vocabulary of *literal* formulas, another vocabulary of *physical* formulas, which from the muscles reach the brain, as do the words through the eyes and ears, and by so doing they may be credited with aiding on the physical side to develop the efficiency of the brain and widen the boundaries of the volitional dominion of individuals, and through them of the nation.

NOTE. Since the delivery of this paper a great many questions have been suggested to me in relation to this subject, among which are two which I desire here to briefly answer.

One is : "At what age shall a training upon such principles begin?" The other : "At what age shall it be considered ended?" No distinctly formulated answer to these questions has ever come to my notice, although Oliver Wendell Holmes seems to have had this subject in contemplation when he said : "The training of a child should begin a hundred years before it is born."

I would suggest as a rule in answer to the first question : Let mental and physical training begin together. That is, as soon as the child is put to intellectual exercises which demand a volitional concentration of mental force, there should begin, to counterbalance it, a drill demanding the volitional concentration of physical powers.

To the second question I would reply :—Such a physical training should run parallel with the whole life. But as life advances, the educational moment in the gymnastic day's order, having fulfilled its mission, must necessarily recede until finally the hygienic portion stands alone as the whole purpose of the drill.

To suit this gradual change of purpose there must be a gradual modification in the arrangement of the practical details of the day's order.

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