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Errata

p. 463, column 2: The first line is missing. It mistakenly appears on p. 464 as the first line of column 1.

p. 463, column 2: The last line continues on p. 464 as the second line of column 1.

p. 468, under the diagram, column 1: Between lines 16 and 17 insert “produce a thought of the third order, it”.

THE SCIENCE AND ART OF CHILD-REARING.

SOME REMARKABLE EDUCATIONAL DISCOVERIES MADE BY AN EMINENT SCIENTIST

BY ELMER GATES.

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IT is not my intention to attempt to cover the whole question of the rearing of children, but only such aspects of this question as grow out of knowledge that has recently been derived by the experimental method.

The first division of my subject relates to parental preparation. This will very soon come within the province of the teacher. It is to the teachers that the parents must look for information, and it is to the teachers that parents must go in order to be trained in the methods for making parental preparation for the begetting of a child. I do not think that this

subject of the early training of children can be properly understood without an explanation of what I mean by parental preparation. The parents should develop in their brains the structures which they would transmit to their children. If they omit any important group of structures the child will probably be born with these groups of structures deficient. If they allow to remain in their brains any structures of an evil character, they may expect their child to manifest those tendencies. This brings us face to face with the general question: Can acquired characteristics be transmitted?

I. THE TRAINING OF THE PARENT.

There have recently arisen in the biological world several eminent men who claim that acquired characteristics cannot be transmitted. Weissmann experimenting upon white mice, by mutilating them, found that acquired characteristics could not be inherited. Sir Francis Galton and others have said that acquired characteristics could not be transmitted for the simple reason that one could not acquire a characteristic that one did not inherit. For some thirty-two or thirty-three generations Weissmann cut off the tails of white mice and found that the last generation was born with tails just as good as any of the ancestors. He said that Chinese women did not transmit their compressed feet; that circumcision is not transmitted, and so on. I do not know by what mode of reasoning he supposed cutting away part of an organism was able to affect the power of transmission. I took white mice for my experimental subject and instead of cutting off their tails, I trained them in the use of their tails as prehensile apparatus; trained them in the

use of their tails as touch-organs and in the feelings of the cold temperature sense and warmth temperature sense, and the fifth generation were born with larger, stronger, longer tails and with the corresponding parts of their brains better developed and with greater sensitiveness to touch and temperature. I trained guinea pigs in the use of the seeing-functions for five generations, according to a method that has been widely published, and the fifth generation was born with more brain-cells in that part of the brain than any guinea pig of that species had ever before had, and at an early age they could make night-discriminations that were impossible to other guinea pigs of the same species. This has proved that acquired characteristics can be given to an animal and, also that these characteristics can be transmitted.

The law is that the mental activities of the parents must create in the brains of the parents the structures in which those mental activities are embodied, and then these structures will be transmitted to the

children just as any other structures of the parents are transmitted. By this means acquired characteristics can be transmitted. Parents, therefore, should utilize and develop every phase of their mental faculties.' That is, they should cultivate each one of the intellectual functions, and each one of their emotional or moral functions, and each of their conative functions, and they should atrophy out of their brains, by the process for curing immoralities, the evil memories and tendencies which they do not desire to transmit. Briefly stated, the parents should get sensations, images, concepts, and ideas by a direct study of each one of the sciences, omitting no one science. This will put new cells and structures in the brain-areas and will stimulate into functional activity each one of the intellectual functions, causing these characteristics to be transmitted. Likewise, the parents should systematically train, by bringing into conscious activity, each one of the tender emotions, and aesthetic emotions, and moral emotions, and logical emotions, and cosmical or religious emotions; bringing into activity, of course, only the happy and cheerful emotions. Avoiding, as you would avoid poison, the exercise, even once, of any one of the evil, depressing, irascible, fearful emotions.

I have elsewhere published my researches upon the relation between emotion and metabolism. Briefly stated, good emotions augment all the nutrient products in the tissues and juices of the body, cause the storing up of energy in the tissues and cells, whilst the evil emotions create poisons in the juices and tissues of the body, lessen the respiration and lower the tide of life generally. It has long been known that all of the chemical changes in the cells called metabolism, may be divided into two great kinds of metabolism: the destructive or life-destroying processes called katabolism and the constructive or life-promoting kind, called anabolism. I found that the good emotions augment anabolism, and that the bad emotions augment katabolism. The parents, during the year's preparation before the creation of the child should have active every day one of the good emotions, and not once during

should, during this time, exercise each one of the intellectual functions in each one of the natural sciences. In order to do this well, parents have to receive a training, and that training means that they have to learn the art of mentation. In order to learn this art, they must first learn it as it is applicable to some one science. The way to do this is to take the parents into a room containing all the objects of that science and then give them the sensations, images, ideas and thoughts relating to that science. For purposes of parental preparation this need take but very little time to produce a sufficient effect and render dominant in their brains the functioning structures which they desire to transmit. Some day we will have an institution where all sciences will be thus represented and where parents can receive this training, and this training will fall under the province of the teacher, and it is for this reason that the teacher shall become prepared in this direction. A few weeks is a sufficient time to get a great number of sensations, images, concepts, and ideas from some one science; sufficient to put many thousand new structures in the brain and to fully render dominant certain groups of structures which otherwise would not be transmitted to the child. One difficulty in parents who have not had a training in the art of mentation, consists in overcoming mental chaosity. I mean by this, that all day long your mind is filled with a floating panorama of images, concepts, ideas, emotions and plans which come unbidden and go unbidden, which have no purpose in your life, which waste your energy and produce a chaotic condition of the brain. The best way to get rid of chaos of this kind is to take a psychurgic training in some one of the sciences so that you may learn how to use the intellections separately from each other; so as to learn how to conceptuate, ideate, etc. Then with a little more effort one can train oneself to prevent this cerebral ataxia.

There is one other important phase of parental preparation and it is very difficult to explain this in the little time at my disposal. It consists in functioning the approvals of the awareness. Your aware-

the year any of the bad emotions. Theirness is that which is conscious of every conscious state that passes through your mind. It is conscious of your consciousness and it sits in judgment upon every motive, every thought, every feeling. It refuses to sanction any act that is not absolutely just and absolutely truthful. I do not mean conscience, though conscience is one of its imperfect modes of expression. Conscience is a creature of education and can be trained to sanction or object to almost every possible form of wrong doing or right doing. It is simply an automatic alarm that rings whenever our actions do not quite correspond to our beliefs. The thing that you believe to be wrong when you do it, will cause your conscience to condemn you; if, afterwards, you find that it was right, your conscience will no longer condemn, but approve. If you will carefully introspect your own mind, you will find from time to time, different groups of sensations, images, concepts, motives and plans passing through your mind, and that all of these states of consciousness are discerned by another higher consciousness, the awareness. If the awareness tells you that you did not tell the truth, it is not in your power to bribe it to any other opinion. It would be easier for you to annihilate the universe itself than to change the verdict of that awareness regarding the truth or justice of any of your motives. The decree is inexorable.

Now, perhaps, the most valuable trait that can be given to a child is this tendency to do right; to want to do as well as it knows how to do. If during my whole life I would do just as well as I know how to do, I would have no fear regarding my success in this world or in any other. If each parent will, for at least a half an hour, each day, go off alone and bring up before this awareness each separate motive and plan and every phase of their intentions for the future, they will find that some will receive the full approval of that which is conscious of the conscious states and that others will not. Those which do not receive the full approval must be abandoned and never brought up in mind again. If the plan or motive which is brought up in the mind is not wholly

good, then the next day only those parts of the plan which have received the approval of the awareness are again brought up in mind. This causes the awareness to functionate its approvals forty or fifty times an hour every day for a year. In most people's lives these approvals are not functionated more than once a month, perhaps not that often. This functioning very rapidly and wondrously increases the dominancy in that person's life of the things that are good and the dropping out of the things that are bad.

It is impossible now to explain the reason for this, or to go into the technical methods for functioning the awareness. A good way to do is to write down every purpose and plan which receives the full approval and of those parts in your purposes which are fully approved of, and then cause the awareness to approve of them many times an hour over and over again. Those particular things that are approved of will grow strong in conscience; will create and rectify your conscience, and those things will begin to succeed in your life and in the lives of others around you. The awareness is that which is immanent in the very nature of mind itself. It is that which is universal in all minds, and it is the universal mentative power selectively approving in your mind all that is worthy of approval, and by bringing these things up continuously they are caused to grow and the others that are not approved of are dropped out. The tendency soon is to do those things voluntarily which are right, and to quit doing those things which are wrong. The fundamental idea is to cause the awareness to rectify the conscience and to cause the conscience, thus rectified, to functionate many times an hour instead of once or twice a year, so as to give it training and skill, and the results will be positively beyond all credulity until tried.

Summing up, then, the whole subject of parental preparation, we may say, that the parents should cause every faculty of the intellect, emotion and conation, to create its structures in the brain before the creation of a child takes place, and that the parents should get mental content, that is, images, concepts, ideas, etc.,

from each great taxonomic group of the sciences so that the corresponding structures may be put in their brains, and so that the child may inherit a harmoniously developed mind and brain.

REGULATION OF PRE-NATAL NUTRITION BY
THE MOTHER DURING THE
GESTATIVE PERIOD.

It will not avail much for the mother to undergo intellectual training during this period, but it will avail much for her to

grow by cell-multiplication.

I found, when experimenting upon the relation between mind and metabolism, that when I saved the poisons that are given off from the breath and other excretions during evil emotions, that these poisons retarded the rate of cell multiplication; that the eunastates of the good emotions stimulated the rate of cell multiplication. It follows that if, during the period of pregnancy, the mother entertains any of the evil emotions she will



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regulate her emotional conditions. Those of you who have made any study of biological subjects will know that the child begins as a single cell and that it grows into a foetus by the multiplication of these cells in number; one cell grows larger and becomes dumb-bell shaped and divides itself into two cells, and the two cells become four cells and so on. That is, the child is produced by cellular multiplication. At certain periods certain organs have their commencement, and this takes place first as several cells, and the organ

throw the corresponding poisons into her blood, and as it is the blood that feeds the child, the *katastates* produced by the evil emotions will arrest the cell-multiplication of the organ which is just forming at that time. Not only must the mother avoid throwing into her blood any of the products of the evil emotions, but she must throw into her blood every day, the nutrient products of each of the good emotions so that every organ of the foetus may receive its normal amount of nutriment of the right kind. The mother

should be in a state of complete restfulness should be happy; should have abundant sleep and great varieties of food, pure air, plenty of light, and first and foremost, she should be daily engaged at some regular work which forms a purpose in her life; a work about which she

can become enthusiastic, and which gives her pleasure. There is, perhaps, no one kind of advice more important than this. In no other way can the conative structures be properly excited, and in no other way can that tedium and ennui so common to pregnancy be prevented.

II. THE EVOLUTION OF AN IDEA.

It is now an accepted rule among pedagogues that the teaching of any subject should conform to the ontogenetic periods in the child's life when such mental activities naturally become dominant. To attempt to teach a subject before the mind of the child is ripe for it, always results in a failure, and to wait until too late a period also always results in more or less of a failure, because it is teaching the subject at the wrong period, and the result is that the subject must be taken up at a period when other subjects should be taught. Then, again, especially since Pestalozzi, it has been an accepted rule that teaching should proceed from the simple to the complex; from the concrete to the abstract. This is more easily stated than done, and one of the things that remains to be determined is the order in which mental integrations take place, commencing with the simplest states of consciousness and integrating them into a state of the next degree of generalization, and so on. At present the teacher has no criterion by which to determine the relative degrees of complexity of the different data of the subject he has tried to teach. I wish, however, to call your attention to data and experiments which, when once they have been fully carried out, will, I believe, offer us a safe criterion by which to solve these problems.

If you will analyze your own mental experiences, you will find that your simplest states of consciousness are sensations. You may become aware of the existence of an outside object by touching it, by feeling its temperatures, by exerting upon it your muscular strength, by smelling it, or by tasting it, or by seeing it, or by hearing the sounds which may be produced upon it, or by it. I think there is no other way in which you

can become aware of the existence of an object outside of yourself. I wish to call your attention to the fact that you cannot have any sensation of roundness, or of length, or of shape, or of distance and perspective. You can only have sensations of touch, of muscular experience, etc., and out of these your mind must construct for itself, by subconscious and conscious apperceptive processes, the images of objects and of their special relations to each other.

Having acquired sensations, experience causes them to become integrated into a mental unit one step higher than sensation, and this mental unit is called an image. The image is a psychologic synthesis of all of the sensations which the corresponding object has produced upon the mind, but the image no longer contains in itself any sensation. You can best understand this statement by imagining yourself deaf and blind and without any senses except touch and muscular motion. Exerting your muscles you can produce upon the end of your finger a series of touches by passing it over an object, and out of these two kinds of sensations your mind has produced an image of distance. You will see that this image of distance contains no sensation in it. The correctness of the image, however, depends upon the completeness and correctness of the sensations which you have acquired from the object.

The acquisition of a great number of images at once compels the mind, by virtue of its power, to detect likenesses and differences, to put like kinds of images together into a class, and this class of images is at once identified in the mind by limiting the consciousness to some one property or attribute common to all of the images of that class. This point of generali-

zation constitutes the sign or mental symbol by which that class of images is known in the mind. It is called a concept. A concept applies to all the images of that class which you have ever seen or which you may ever see, that is, it outruns your experience. Having, e.g., from a number of images of different kinds of ships, arrived at the notion that a vessel that is buoyant upon liquids, for transportation purposes, is a ship, you will ever after put any kind of a floating vessel that you may ever see into that class. A concept can be stated as an abstract definition. Naming, and the use of words commences with conceptualization. Concepts cannot arise in the mind until there are classes of images in the mind, and the concept is more or less accurate according as its images are more or less accurate and more or less correctly classified. I may receive a number of sensations from different kinds of magnets: the horse-shoe magnet; the bar-magnet; the electro-magnet; the natural magnet of hematite iron ore, and out of these will arise images grouped into a class so as to distinguish them from other kinds of magnets named, and these images grouped into a class so as to distinguish them from other kinds of electrical objects, constitute a concept of magnet. In a similar manner I can achieve a concept of heat by having experiences with different modes of producing heat.

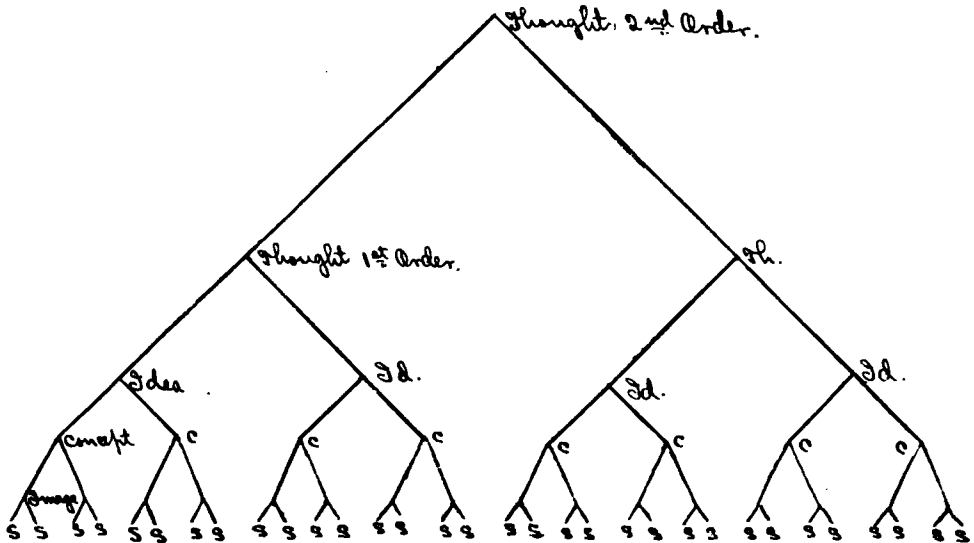
The next step in the order of our mental evolution consists in finding what relations exist in nature between one class of objects and another; that is, between the concept of one class and another class, and this relationing of concept to concept I have called ideation, and I limit the meaning of the word to a relation between concepts. If you will refer to your dictionaries and psychologic treatises, you will find that the definitions of such words as "notion," "concept," "idea," "thought," "reason," "image," have meanings very much alike and often one covers part of the ground covered by another, and that no precise meaning has been given to any one of them. Of course, scientific thinking cannot be performed by this means. The meanings which I am now giving of these psychologic terms are more limited

than those usually applied to them and often quite different, but there are no other words in the language which may be used, and I think the meanings I have given are in keeping with the real use of these functions by the human race. To relation each concept of a science with each other concept of that science, includes the whole sphere of experimental research in that domain. That is, ideas can be obtained only by observing the experiments which nature makes for us or by making experiments of our own.

Ideas are relations between concepts; that is, relations between classes of objects in nature. Then, the relationing of ideas constitutes thinking of the first order. I will illustrate by a concrete example. Out of the sensations which I may have derived from electrical phenomena, and out of the images produced by the synthesis of these sensations, I may have achieved a certain number of concepts of magnetic and electrical phenomena, and by relationing these concepts I may have achieved such an idea as the following: namely, that the attraction of a magnet diminishes as you get farther away from the magnet. From a similar line of acoustical experiences, I may have determined the idea that as you get farther away from the source of a sound it grows less loud. In a similar way I may have achieved the idea that as you get farther away from the source of light it grows less brilliant. I may also have an idea, derived from geometrical studies, that radiant lines, starting from a point, have a divergence wider the farther you get away from that point. And by apperceptive processes these ideas in my mind become embodied into a truth common to all of them, namely, that any force emanating in radiant lines from a point is spread over a larger area the farther it travels from that point; and I think at once that all forces must diminish in intensity over a given area as you recede from their source, and I see also that this diminution must be inversely as the square of the distance, because, such is the geometrical relationship. This truth, common to all these separate ideas, is a thought or law of the first order, and it

will apply to forces that have not yet been discovered. I will graphically represent this scheme of the different degrees of

mental integration by the following method:



The lower row of letters represents different sensations from different senses, and I have graphically indicated that a union of two sensations produces an image. There is only one instance known where two sensations produce an image; it nearly always requires many more. I have also represented that the union of two images will produce a concept. Concepts nearly always consist of many more than two images. The union of two concepts represent an idea, and the union of two ideas a thought of the first order, and the union of two thoughts of the first order give rise to a thought of the second order. In order to will be necessary to build up another diagram of equal dimensions in the same or another science, and then I could connect the two thoughts of the second order and produce a thought of the third order, and at this degree of generalization most sciences end. To the extent that our present methods fail to give the child all of the sub-units of each of these integrants, to that extent our methods are wrong, and this study of the degrees of integration will enable the thoughtful teacher to make the improvements needed. But before he can do so, there must be a study made of

the natural history of these different degrees of integration. I am engaged at this work, but it will require the co-operation of many able people for several years to accomplish it. It is my purpose to determine scientifically the actual sensations out of which the different possible images of the sciences are composed. Also to determine precisely the actual images out of which our concepts have arisen. Also to determine the actual concepts which the human race has achieved in each of the sciences. We need to know the actual number of concepts in each science and precisely the images out of which they have arisen. A concept cannot be achieved by guess work. It must arise out of a definite experience with objects and phenomena. Then we determine the actual relation existing between each concept and each other one by the experimental method. The next step will consist in relating the ideas into thoughts of the first order, and at that stage we leave the domain of experimentation and enter into the domain of pure thinking.

This study of the natural history of each element of human knowledge is called the collection of the mentative data of the sciences. It consists in experimentally

determining for each science the sensations, images, concepts, ideas and thoughts. Then the teacher will have a direct guide as to the order in which he should proceed from the simple to the complex, and it will be a criterion regarding the subject matter which he is to teach, and the order in which it is to be taught. That is, the natural taxonomy of knowledge is the true criterion for the arrangement of an educational curriculum. This must be done for each science, and then the teacher will have a criterion for the order in which a complete education is to be given. All of the data of the sciences will then have been classified according to the degrees of mental integration. This classification will then be a guide to the elimination of error and to the determination of the truth. It is the order in which brain-building should take place. I will not devote any time to the equally important and equally great curriculum for the emotional and moral training. Our languages have not even names for the different steps in the moral curriculum as compared to the intellectual curriculum.

Then there is also a third curriculum, called the conative, upon which I will not now dwell. I shall, within a year, start at my laboratory at Chevy Chase, one room fitted up with all of the objects and phenomena of some one science and a selected class of pupils will be taught this science according to the new method. First, in the presence of these objects, they will be given every sensation which these objects can give them. Then they will be given correct and equally vivid

images of each object belonging to that science. Then they will be asked to use that most fundamental of all psychologic functions, the power to detect likenesses and differences, to classify these objects into groups containing like kinds, and thus will arise correct concepts. They will be given every concept known to the science. Then, by the experimental method, they will be caused to relation each concept with each other one and thus get their ideas, and then to relation their ideas into thoughts. They will thus avoid all speculation, hypothesis and theory, and will learn the science first-hand. The Cosmic universe has produced their minds and, therefore, their minds cannot be in fundamental antagonism to that universe, and if they get their sensations, images, concepts, etc., directly from the phenomena of that universe, they will achieve real knowledge. Then, having thus rebuilt their brains with reference to that science they will be able to pass through their minds the concepts, or the images, or the ideas, or the thoughts, and thus learn to carry on any one intellectual process without any of the others, and therein they become rulers in their own minds and chaos ceases to exist for them. To assume to master any one science completely without the aid of other sciences is to attempt an impossibility. The specialist is self-limited. Like Saint Simon Stylites, he stands upon his column alone and isolated. The true way to take the next step in any one science is to build up another science to the same degree of integration and then the two highest integrants can be relationed into the next higher step.

III. HARMONIOUS MIND DEVELOPMENT.

I wish you to think of mind-unfoldment as a process of organism-building. It is not the brain alone which constitutes the organism for the mind, but the whole body. Every mental activity creates in some part of the organism a new structural change in which conscious memories are enregistered in the brain cortex. The true content of a normal mind consists of the sensations, images, concepts, etc., of each of the different sciences, and an equal

development of the emotional and moral curriculum, and an equal development of the conative curriculum. It has often been stated that function precedes structure. My experiments have shown that it is psychologic functioning that creates organic structure, and that organic structure is a manifestation in concrete of the activities of the mind. Aurelio Lui, in Italy, has concluded from experiments, that as animals more and more acquire the

faculty for walking that more and more cells are developed in the motor-regions of the brain. Long before his experiments I proved that by giving animals a comprehensive training in the use of the seeing-functions, there was created in their brains a greater number of brain-cells, and I applied this same line of experiment to other senses and to other mental functions with similar results. The curing of immoral tendencies is itself a demonstration of the truth of the brain building processes. When I put into a criminal's mind a hundred times more good structures than he has evil structures, and then keep these structures functionally active often-er than the evil ones, there is produced atrophy or wasting away of the evil structures and growth of the new structures.

Perhaps nothing could be more fatally erroneous than an attempt to impose a theory of education upon a child. What we want is not a theory of education, but a knowledge of what is the natural order of mind-unfoldment and brain-development, so that we may humbly follow it. We need not only a knowledge of the order of brain growth and mind-unfoldment, but what is equally valuable, we need a knowledge of the actual content of modern science, arranged into taxonomic groups of data, and each group classified into the different degrees of integration. This is the content that should be put into the normal mind. When any one subject is taught to the exclusion of others, then an abnormal number of cells and structures are put into one part of the brain and this produces unequal development. And with all unequal development there goes, not merely mental disease, but bodily imperfection. The tendencies of our social environment are such that a child is generally, by suggestion and direct training, compelled to over-develop one or two parts of its mental nature and to leave all the other parts undeveloped. In order to prevent this, it is necessary to bring into systematic activity each one of the intellections; that is, the sensations, images, concepts, ideas and thoughts belonging to each great scientific group of phenomena. To omit any one science from the training of a child is to omit one part of its mind

from being developed; it is to omit part of its structural development in the brain, and to make it a psychologic and logical abnormality and, consequently, an immoral and unsane person.

When the child has reached the age at which it begins to distinguish different kinds of sensations, that is the time to give it this sensory training. Sensation at that time is more vivid and means more to it than at any subsequent period of its life. As soon as it begins to discriminate between images of objects, then is the time to give it its image-training, and when it begins to form concepts, then is the time to give it its conceptual-training. And it should receive typical concepts from each science. As soon as it begins to discover relations between concepts then is the time to give it its experimental training in the sciences not in one science, but in all sciences. It will require less time to develop all of the sciences than to develop one or two of them, for reasons which I will not now go into.

So far, my conclusion, in concretest form, is this: During the first two years of the child's life, give it typical sensations and images, from each scientific group during the third year give it concepts and ideas, which process should be continued through the kindergarten and primary school curriculum, the details of which will require a large volume to explain. A book containing the classified mentative data of the sciences should be in the hands of the teacher so that it may be known what mental content properly belongs to the child at any given stage, and so that the teacher may not attempt to teach fourth degree integrations before the child has learned the third; so as not to attempt to teach concepts before the child has acquired the images out of which those concepts should arise; so as not to attempt to teach ideas before the child has acquired the concepts the relationing of which produce those ideas, and so on.

Great care should be taken to prevent over or under-development of any part of the brain or of any scientific subject. There will exist in the normal text-book the criteria for guidance. The child

should, step by step, study from nature and not from books; study objects instead of paragraphs. To read a statement of an idea is to produce in the child's mind an accept and not a concept, and normal mentation cannot arise therefrom. Every group of sensations or images should be repeated every day for at least five successive days, and the repetition should always take place at precisely the same hour, so as to take advantage of the great law of periodicity of functioning. The lesson should always be wholly pleasurable to the child. Mind is what we are, but mind is of no use without knowledge of truth to guide it.

Truth would be of no avail without mind to contemplate it. The normal content of mind is truth. I wish to emphasize the fact that there is no knowledge except of objects and their relations; and that untrue mental content is abnormality.

From the standpoint of the kindergarten, I wish to make a few remarks. Play and self-activity should be the key-note throughout the cradle and kindergarten curriculum. There should be no teaching except as it come as the natural and spontaneous impulse of the child to play. I will explain why. The first step in mental unfoldment is the acquisition of sensations. Without them the next step could not be taken. Think of this a moment and you will at once see the great importance of correct sensory training now so largely neglected. But the next step cannot arise without the volitional effort of the child; mark that. Two sensations, such as of touch and muscular motion, constitute the simplest known image when integrated, but in order to integrate them the child must by its own conscious volitional effort move its muscles; that is, it discovers when it makes an effort to move its finger along the surface of an object that it causes a series of touches to be felt and that if it ceases the effort of moving the muscles no such touches are felt. If the child were entirely passive, and if it had always been passive, knowing only its own interior organic states, and if another person were to move an object over its finger, it could

not therefrom know that the sensations were caused by an outside object and could not integrate the touch-memories into an image of distance. It is only when by its own effort it causes its finger to be moved that it finds that a series of touches are produced by an outside object. Hence, the simplest image is the result of the integration of a series of muscular-motion sensations with a series of touch-sensations, plus a corresponding series of volitional efforts. This volitional effort is, of course, self-activity. If self-activity had not first arisen in the mind of the child the sensations could not have been integrated into an image. This is true of all the higher stages of mental integration, and every step of a normal education consists in not merely acquiring brain-structures; not merely in achieving a mental content of truth, but most specifically in training the power of a child in self-activity of higher and higher degrees of integration.

I cannot longer dwell upon this, except to say that in animals the play spirit does not arise except when they have been well fed and well rested, so as to acquire surplus energy. This surplus energy must manifest itself in some way, either in muscular activity for the sake of mere exertion, or in different forms of play, and out of this fundamental play spirit arises aesthetics. As soon as the child has mastered any one concept in any one science, it should be taught the name of the concept. But it should not be taught the names of any objects to which its attention is not spontaneously attracted. If of its own volition it has its attention attracted to an apple, then the word "apple" should be pronounced distinctly a number of times, and during that time the child should be given the nine kinds of sensations which the apple may give it. It should see and feel the inside and outside of the apple and every particular structural part thereof. It may thus be allowed, when over fourteen months old, to notice not more than two or three objects daily in this manner and have them named, and having thus studied an object, it should again study the same object the next day, and so on for five consecutive

days. Probably about the fourth day it will itself give the name of the object, and when it has done so several times, the name should be placed in the list of objects that have already been learned. By this method I know of a child that at sixteen months of age had learned the use of 380 words; could, on seeing the object, give its name, or on being told the name, point out the object.

Step by step with the intellectual training there must take place a careful moral training, and this would be of more importance were it not for the fact that the moral training cannot arise except out of the intellectual training. A moral act involves the adaptation of acts to ends. That is, it must be based upon a knowledge of the things acted upon and the things in the presence of which we act. We cannot purposively act until we have concepts and ideas of the action, and this is an intellectual process. If you will again refer for a moment to the outline drawing representing diagrammatically the intellectual curriculum, you will be able to understand better what I say when I remark that there is a moral series of mental integrants exactly corresponding to this intellectual series. Thus, every sensation may be either pleasurable or painful. Every image may have, or not have, artistic value. Every concept may be of objects that are either useful or harmful, and so on, and out of these feelings there arises our whole emotional and moral disposition. To allow the child to acquire any of the life-destroying and evil emotions, is to allow it to develop to that extent, into an immoral or criminal person. On the contrary, it should be given regular exercise in each one of the tender emotions, in each one of the aesthetic emotions, and in each one of the moral emotions, and in the logical emotions and in the Cosmic or religious emotions. Seek by any possible means of distraction to divert the child from a repetition of any irascible or wrong emotion which it may have. The best way to divert it is to get it into some normal kind of play or activity. This is far better than to correct the child or to scold it. Every repetition of a wrong emotion further enregisters

its structures in the brain and makes it stronger and stronger. The evil emotions, as I have elsewhere published, fill the body with poisons and lower every mental function. The good emotions do the reverse. Thus, in its very chemical nature the universe is moral. All organic life is subject to the law that the good emotions tend to increase the life and the evil emotions to diminish it.

Now, we have arrived at a conception of the criterion which will enable us to decide regarding the subject-matter of our teaching. It must consist in giving the child, in the first stage of its training, the mental units of the first order, belonging to each great scientific group of objects. This is the sensation stage. We need instruments for easily exhibiting to the child every normal and typical sensation, and we need typical objects of each species of thing for this purpose. The next step consists in giving the child the second degree of mental integrations or images, and here again we need a museum containing a specimen of every typical species of thing. The next step consists in teaching the child the concepts of all of the sciences; not one of them; and the third step consists in giving the child the ideas.

Before this method can be applied to our school system, there must be made a systematic and accurate study of each of the sciences so as to collect, from the great literature of the world, and from the object and phenomena of the sciences all of the mentative data of each science. This will require the co-operation of many thousand people, and it will require the working over of the entire content of science in an experimental laboratory so as to eliminate the false and conserve the true. I am, with the help of others, organizing this work, namely, the collection of the mentative data of the sciences. In order to work over any science in a laboratory, we need first a statement of all that the human race has supposed to be true in that science. This requires a study of literature of the world so as to get into one concrete volume the alleged truths of each science, which statements are afterwards to be experimentally examined.

We need text books representing each of the different sciences, the contents of which books are to be classified into sensations, images, concepts, etc. Until this work has been accomplished, the teacher cannot have the daily guidance needed.

The next step consists in discovering, by a long series of psychologic measurements, the periods at which normal children naturally develop each different mental capacity. No such study as far as I know, has as yet been comprehensively made. I mean that by aid of psychologic instruments there has been no month-by-month series of measurements of infants and children to determine precisely at what periods the different sensory and imaging and concepting and ideating faculties arise into dominancy.

Hence, I propose to the teachers of this country, that a series of such measurements be carried on. I will give you a concrete idea of what I mean. Each teacher should have a set of instruments to be used in measuring the sensations, the imaging-time, the conceptuating time, the ideating time and the emotions, etc. Instruments to be used in measuring the effects of each environmental condition upon each one of the mental faculties: instruments to be used in determining the comparative measurements of the children so that we may know in what respect any child is more or less mentally developed than another child, and so on. By means of aesthesimeters a series of touch-measurements can be made to discover, e. g., the least weight which will cause a touch-sensation, and the least distance between two such touch-points which will not feel as one touch, and so on. With a baroesthesiometer the different pressure sense phenomena can be determined. Thus, having placed upon a particular part of the child's hand a 1-gramme weight, it remains to be determined what is the least additional weight suddenly added thereto which the child can feel as an additional weight. By means of the thermoesthesiometer the temperature can be measured, and by means of a chronograph the muscular reaction-time to touch and temperature and color and sound can be measured. By means of an insulated iso-

lation chamber environmental conditions such as the barometric pressure, and electrical potential and light, etc., have their effect upon each one of the child's intellects and emotions measured, and by measuring these different children in such a chamber from which all environmental forces have been excluded, we can find their mental acuteness as compared to that of other children. That is, we can determine their place in the psychologic scale of the human race.

I hope to make a portable apparatus which can be used by teachers in taking their monthly or annual measurements of babies and children so as to determine at what ages the different sensory and imaging and emotive faculties arise, and so as to determine the comparative psychologic development of children, so that we may know how to differently train the apt child as compared to the less apt child, and so as to know how to regulate the environmental conditions of children so as to produce the best results. I began, a number of years ago, to make such a series of psychologic measurements of children and of older people and have carried it on month by month and year by year upon the same people, but I have not yet sufficient data to warrant me in making, or at least, in publishing, any generalizations, except a few. Several thousand people should be measured once a month or once a year, for a number of years, so that we may know at about what ages different mental faculties take their rise and at what ages they begin to deteriorate; so that we may know by measuring children at what time we should teach that particular child, because children vary greatly in mental acuteness. If one child's measurements show greater mental evolution than another's, then the two children should not be forced through the same curriculum and the same training at the same time.

While making these psychologic measurements I have accidentally found a very practical hygienic result which I think it worth while to mention because it has attracted great attention from eminent physicians. One man, who every six months when he was measured, could feel one-

fourth of a milligramme upon the middle segment of his little finger and who could see a difference of 1 per cent between two tints of red, was at one measurement unable to feel four milligrammes in weight, and to see a three per cent difference in the two tints. At a subsequent measurement the same psychologic defection existed, and so on for two subsequent measurements. When I next heard from him, he had given up all business because of the advent of a disease, chronic in character. A number of such results have led me to discover that, long before a person gets sick; long before they have the first symptoms of that sickness; long before any known method of diagnosis would reveal the presence of such a disease, those psychologic measurements, by the falling off of any one of them in their former degree of acuteness or speed, will indicate the approach of such a disease. I have gone far enough to state positively that most diseases can be detected by psychologic measurements long before the patient has any symptoms of that disease. Of course,

this is the time to make a change in that person's habits or in the person's moral or intellectual life, so as to cure the approaching ailment. It is my purpose during the next two years to carry on such measurements so as to determine, if possible, what particular psychologic defections indicate what particular kinds of approaching diseases. It is obvious that these series of measurements will be of great practical benefit in regulating the health of a child, and I predict that the time is not far distant when most people will have at least annual measurements made. After a sufficient number of people have thus been measured for a sufficient length of time, we will know what we do not now know, the ontogenetic periods of the possible difference in the emotional and conative faculties, and we will know how to detect, by measurements, the mentally dull child from the mentally apt child, and we will receive direct aid in regard to the times in teaching different subject-matters to children.

IV. MORAL TRAINING NEEDED.

I will close by calling attention to the fact that it has not usually been thought necessary, in practice, to give a child a moral training. We think it necessary to train the child, by frequent repetition, to ride a bicycle, or to play the musical scales, or to declaim, or to write. In fact, the whole process of education is intellectual training. What I would like to see carried out in our public schools is a similar process of moral training. A child should be trained in the doing of moral acts until the doing of such an act becomes perfectly natural. After graduation, our children are turned out upon the world without having had any adequate training in doing moral things; in resisting temptations and in regulating their own lives. All known moral acts should be performed over and over again by the child and until the doing of them becomes as much second nature as the lifting of the hat when a gentleman approaches a lady or in doing the usual acts of etiquette and politeness. Moral strength and moral skill can be achieved in no other way than

by the doing of moral things. Hence, a series of conduct practices should be devised which will bring into play, systematically, all of the normal emotions in connection with such lines of conduct as the child will find in his future life.

I wish also to call attention to another matter which has recently attracted much attention: the introduction of manual training-schools and to the more extensive use of scientific laboratories, and in such an institution as in Prof. Miller's Textile School, in Philadelphia, the direct union of science with art in preparing the pupil for a vocation in future life. It is not sufficient to learn the theory of a subject. The pupil should learn the actual doing of some vocation of some art in full; that is, the practice of details and teaching of the theoretical part of a subject should not be divorced from the practical part nor should it be divorced from the moral or aesthetical part. As soon as a child has mastered one stage of intellectual acquisition in any science, such as, for instance, the ideative stage, it should at once acquire

the corresponding emotional and moral training arising therefrom, and simultaneously therewith it should be taught those arts out of that knowledge and moral growth. The three lines should not be independent, but simultaneous.

To epitomize my article, I desire to call attention to the fact that these series of studies have arisen out of the discovery of an art of promoting mentation, and that the first great result of this art was the discovery of the method for giving the child more mind. The whole object of education and of life itself is the getting of more mind intellectually and morally, and in learning how to use it in the discovery of truth and its conative application to the betterment of the affairs of life. The whole educational curriculum should be directed so as to give the child not merely more mind, but a mind equally developed in each of its faculties; and so as to give it skill in using the mind in the actual conditions and vocations of life. The training which does not guide the child in its every-day occupations, in matters of dress, eating, sleeping, walking, marrying, making money, and in properly conducting social relations, in achieving reputation and success, is a training that is not the kind which the modern age demands. I expect that during the next ten or fifteen years there will be much work done that will corroborate and add to the researches out of which have grown the six branches of psychology and the six branches of psychurgy. I expect these things to become part and parcel of our methods of education and I am sure that no kind of opposition can long defer this much-needed progress. There is undercurrent in the minds of the whole human race a feeling that great changes are taking place, and it is evident from the study of the various fads and movement that the progress is tending towards a greater knowledge of the human mind. All this effort along the lines of these various fads should be turned into constructive and scientific work, and I venture the prediction that such will soon come to pass.

I have called your attention to the fact

that the proper time to begin to train a child is at least a year before it is created; that the parents, by exercising each of the intellectual, emotive and conative faculties in each of the sciences, and by a proper moral training, should eliminate from their minds whatever immoral tendencies they may have in their brains, and thus by creating normal structures in their brains they will transmit to their children a normal and equally developed mind. I also spoke of the functionings of the approvals of the Awareness, so that at least 100 approvals should be made of all the motives and purposes which the Awareness will approve of before the child has been created. I do not wish you to misjudge these statements because the subject is quite complex and very difficult to explain in a few paragraphs. I have also called your attention to the regulation of the mother's emotional conditions during the gestative period; that she should have daily active one of the good emotions. This, of course, requires technical training. No one can do this without several year's such training. I also said that the time would come when parents would go to teachers for such training. The mission of the teacher in the modern world becomes ever greater and more important. Then I spoke of the cradle curriculum, and gave you a brief idea of the order of the different degrees of mental integrations, and said that we needed text-books containing the data of the different sciences psychologically classified, and that such a work is in progress. I desire, also, to emphasize the fact that a knowledge of the taxonomy of the sciences and of the ontogenetic periods in the child's life should enable us to prevent the over or under development of any part of the child's mind. I said that the self-activity is essential to every step of mental development beyond that of sensation, and I close by calling your attention to the great need for a series of monthly or yearly psychologic measurements of children.

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