GEORGE HERBERT BETTS

THE MIND AND ITS EDUCATION

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Содержание

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PREFACE TO THE REVISED EDITION

Authors, no doubt, are always gratified when their works find favorable acceptance. The writer of this text has been doubly gratified, however, at the cordial reception and widespread use accorded to the present volume. This feeling does not arise from any narrow personal pride or selfish interest, but rather from the fact that the warm approval of the educational public has proved an important point; namely, that the fundamental truths of psychology, when put simply and concretely, can be made of interest and value to students of all ages from high school juniors up, and to the general public as well. More encouraging still, it has been demonstrated that the teachings of psychology can become immediately helpful, not only in study or teaching, but also in business or profession, in the control and guidance of the personal life, and in the problems met in the routine of the day's work or its play.

In effecting the present revision, the salient features of the original edition have been kept. The truths presented are the most

fundamental and important in the field of psychology. Disputed theories and unsettled opinions are excluded. The subject matter is made concrete and practical by the use of many illustrations and through application to real problems. The style has been kept easy and familiar to facilitate the reading. In short, there has been, while seeking to improve the volume, a conscious purpose to omit none of the characteristics which secured acceptance for the former edition.

On the other hand, certain changes and additions have been made which, it is believed, will add to the strength of the work. First of all, the later psychological studies and investigations have been drawn upon to insure that the matter shall at all points be abreast of the times in scientific accuracy. Because of the wide use of the text in the training of teachers, a more specific educational application to schoolroom problems has been made in various chapters. Exercises for the guidance of observation work and personal introspection are freely used. The chapter on Sensation and Perception has been separated into two chapters, and each subject given more extensive treatment. A new chapter has been added on Association. The various chapters have been subdivided into numbered sections, and cut-in paragraph topics have been used to facilitate the study and teaching of the text. Minor changes and additions occur throughout the volume, thus adding some forty pages to the number in the original edition.

Many of the modifications made in the revision are due to valuable suggestions and kindly criticisms received from many

teachers of the text in various types of schools. To all who have thus helped so generously by freely giving the author the fruits of their judgment and experience he gladly renders grateful thanks.

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CHAPTER I

THE MIND, OR CONSCIOUSNESS

We are to study the mind and its education; but how? It is easy to understand how we may investigate the great world of material things about us; for we can see it, touch it, weigh it, or measure it. But how are we to discover the nature of the mind, or come to know the processes by which consciousness works? For mind is intangible; we cannot see it, feel it, taste it, or handle it. Mind belongs not to the realm of matter which is known to the senses, but to the realm of *spirit*, which the senses can never grasp. And yet the mind can be known and studied as truly and as scientifically as can the world of matter. Let us first of all see how this can be done.

1. HOW MIND IS TO BE KNOWN

The Personal Character of Consciousness.—Mind can be observed and known. But each one can know directly only his own mind, and not another's. You and I may look into each other's face and there guess the meaning that lies back of the smile or frown or flash of the eye, and so read something of the mind's activity. But neither directly meets the other's mind. I may learn to recognize your features, know your voice, respond to the clasp of your hand; but the mind, the consciousness, which does your thinking and feels your joys and sorrows, I can never know completely. Indeed I can never know your mind at all except through your bodily acts and expressions. Nor is there any way in which you can reveal your mind, your spiritual self, to me except through these means.

It follows therefore that only *you* can ever know *you* and only *I* can ever know *I* in any first-hand and immediate way. Between your consciousness and mine there exists a wide gap that cannot be bridged. Each of us lives apart. We are like ships that pass and hail each other in passing but do not touch. We may work together, live together, come to love or hate each other, and yet our inmost selves forever stand alone. They must live their own lives, think their own thoughts, and arrive at their own destiny.

Introspection the Only Means of Discovering Nature of Consciousness.—What, then, is mind? What is the thing that we

call consciousness? No mere definition can ever make it clearer than it is at this moment to each of us. The only way to know what mind is, is to look in upon our own consciousness and observe what is transpiring there. In the language of the psychologist, we must *introspect*. For one can never come to understand the nature of mind and its laws of working by listening to lectures or reading text books alone. There is no *psychology* in the text, but only in your living, flowing stream of thought and mine. True, the lecture and the book may tell us what to look for when we introspect, and how to understand what we find. But the statements and descriptions about our minds must be verified by our own observation and experience before they become vital truth to us.

How We Introspect.—Introspection is something of an art; it has to be learned. Some master it easily, some with more difficulty, and some, it is to be feared, never become skilled in its use. In order to introspect one must catch himself unawares, so to speak, in the very act of thinking, remembering, deciding, loving, hating, and all the rest. These fleeting phases of consciousness are ever on the wing; they never pause in their restless flight and we must catch them as they go. This is not so easy as it appears; for the moment we turn to look in upon the mind, that moment consciousness changes. The thing we meant to examine is gone, and something else has taken its place. All that is left us then is to view the mental object while it is still fresh in the memory, or to catch it again when it returns.

Studying Mental States of Others through Expression.—Although I can meet only my own mind face to face, I am, nevertheless, under the necessity of judging your mental states and knowing what is taking place in your consciousness. For in order to work successfully with you, in order to teach you, understand you, control you or obey you, be your friend or enemy, or associate with you in any other way, I must *know* you. But the real you that I must know is hidden behind the physical mask that we call the body. I must, therefore, be able to understand your states of consciousness as they are reflected in your bodily expressions. Your face, form, gesture, speech, the tone of voice, laughter and tears, the poise of attention, the droop of grief, the tenseness of anger and start of fear,—all these tell the story of the mental state that lies behind the senses. These various expressions are the pictures on the screen by which your mind reveals itself to others; they are the language by which the inner self speaks to the world without.

Learning to Interpret Expression.—If I would understand the workings of your mind I must therefore learn to read the language of physical expression. I must study human nature and learn to observe others. I must apply the information found in the texts to an interpretation of those about me. This study of others may be *uncritical*, as in the mere intelligent observation of those I meet; or it may be *scientific*, as when I conduct carefully planned psychological experiments. But in either case it consists in judging the inner states of consciousness by their physical

manifestations.

The three methods by which mind may be studied are, then: (1) text-book *description and explanation*; (2) *introspection* of my own conscious processes; and (3) *observation* of others, either uncritical or scientific.

2. THE NATURE OF CONSCIOUSNESS

Inner Nature of the Mind Not Revealed by Introspection.—We are not to be too greatly discouraged if, even by introspection, we cannot discover exactly *what* the mind is. No one knows what electricity is, though nearly everyone uses it in one form or another. We study the dynamo, the motor, and the conductors through which electricity manifests itself. We observe its effects in light, heat, and mechanical power, and so learn the laws which govern its operations. But we are almost as far from understanding its true nature as were the ancients who knew nothing of its uses. The dynamo does not create the electricity, but only furnishes the conditions which make it possible for electricity to manifest itself in doing the world's work. Likewise the brain or nervous system does not create the mind, but it furnishes the machine through which the mind works. We may study the nervous system and learn something of the conditions and limitations under which the mind operates, but this is not studying the mind itself. As in the case of electricity, what we know about the mind we must learn through the activities in which it manifests itself—these we can know, for they are in the experience of all. It is, then, only by studying these processes of consciousness that we come to know the laws which govern the mind and its development. *What* it is

that thinks and feels and wills in us is too hard a problem for us here—indeed, has been too hard a problem for the philosophers through the ages. But the thinking and feeling and willing we can watch as they occur, and hence come to know.

Consciousness as a Process or Stream.—In looking in upon the mind we must expect to discover, then, not a *thing*, but a *process*. The *thing* forever eludes us, but the process is always present. Consciousness is like a stream, which, so far as we are concerned with it in a psychological discussion, has its rise at the cradle and its end at the grave. It begins with the babe's first faint gropings after light in his new world as he enters it, and ends with the man's last blind gropings after light in his old world as he leaves it. The stream is very narrow at first, only as wide as the few sensations which come to the babe when it sees the light or hears the sound; it grows wider as the mind develops, and is at last measured by the grand sum total of life's experience.

This mental stream is irresistible. No power outside of us can stop it while life lasts. We cannot stop it ourselves. When we try to stop thinking, the stream but changes its direction and flows on. While we wake and while we sleep, while we are unconscious under an anæsthetic, even, some sort of mental process continues. Sometimes the stream flows slowly, and our thoughts lag—we "feel slow"; again the stream flows faster, and we are lively and our thoughts come with a rush; or a fever seizes us and delirium comes on; then the stream runs wildly onward, defying our control, and a mad jargon of thoughts takes the place

of our usual orderly array. In different persons, also, the mental stream moves at different rates, some minds being naturally slow-moving and some naturally quick in their operations.

Consciousness resembles a stream also in other particulars. A stream is an unbroken whole from its source to its mouth, and an observer stationed at one point cannot see all of it at once. He sees but the one little section which happens to be passing his station point at the time. The current may look much the same from moment to moment, but the component particles which constitute the stream are constantly changing. So it is with our thought. Its stream is continuous from birth till death, but we cannot see any considerable portion of it at one time. When we turn about quickly and look in upon our minds, we see but the little present moment. That of a few seconds ago is gone and will never return. The thought which occupied us a moment since can no more be recalled, just as it was, than can the particles composing a stream be re-collected and made to pass a given point in its course in precisely the same order and relation to one another as before. This means, then, that we can never have precisely the same mental state twice; that the thought of the moment cannot have the same associates that it had the first time; that the thought of this moment will never be ours again; that all we can know of our minds at any one time is the part of the process present in consciousness at that moment.

The Wave in the Stream of Consciousness.—The surface of our mental stream is not level, but is broken by a wave which

stands above the rest; which is but another way of saying that some one thing is always more prominent in our thought than the rest. Only when we are in a sleepy reverie, or not thinking about much of anything, does the stream approximate a level. At all other times some one object occupies the highest point in our thought, to the more or less complete exclusion of other things which we might think about. A thousand and one objects are possible to our thought at any moment, but all except one thing occupy a secondary place, or are not present to our consciousness at all. They exist on the margin, or else are clear off the edge of consciousness, while the one thing occupies the center. We may be reading a fascinating book late at night in a cold room. The charm of the writer, the beauty of the heroine, or the bravery of the hero so occupies the mind that the weary eyes and chattering teeth are unnoticed. Consciousness has piled up in a high wave on the points of interest in the book, and the bodily sensations are for the moment on a much lower level. But let the book grow dull for a moment, and the make-up of the stream changes in a flash. Hero, heroine, or literary style no longer occupies the wave. They forfeit their place, the wave is taken by the bodily sensations, and we are conscious of the smarting eyes and shivering body, while these in turn give way to the next object which occupies the wave. Figs. 1-3 illustrate these changes.

Fig. 1

Fig. 2

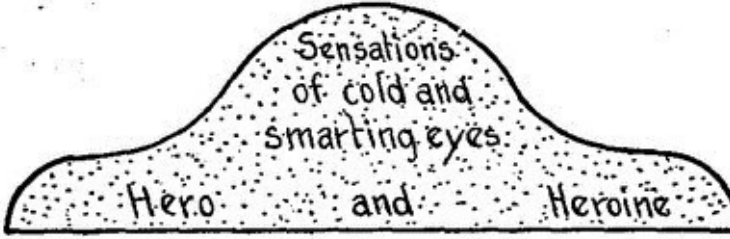

Fig. 3

Consciousness Likened to a Field.—The consciousness of any moment has been less happily likened to a field, in the center of which there is an elevation higher than the surrounding level. This center is where consciousness is piled up on the object which is for the moment foremost in our thought. The other objects of our consciousness are on the margin of the field for the time being, but any of them may the next moment claim the center and drive the former object to the margin, or it may drop entirely out of consciousness. This moment a noble resolve may occupy the center of the field, while a troublesome tooth begets sensations of discomfort which linger dimly on the outskirts of our consciousness; but a shooting pain from the tooth or a random thought crossing the mind, and lo! the tooth holds sway, and the resolve dimly fades to the margin of our consciousness and is gone.

The "Piling Up" of Consciousness is Attention.—This figure is not so true as the one which likens our mind to a stream with its ever onward current answering to the flow of our thought; but whichever figure we employ, the truth remains the same. Our mental energy is always piled up higher at one point than at others. Either because our interest leads us, or because the will dictates, the mind is withdrawn from the thousand and one things we might think about, and directed to this one thing, which for the time occupies chief place. In other words, we *attend*; for this piling up of consciousness is nothing, after all, but attention.

3. CONTENT OF THE MENTAL STREAM

We have seen that our mental life may be likened to a stream flowing now faster, now slower, ever shifting, never ceasing. We have yet to inquire what constitutes the material of the stream, or what is the stuff that makes up the current of our thought —what is the *content* of consciousness? The question cannot be fully answered at this point, but a general notion can be gained which will be of service.

Why We Need Minds.—Let us first of all ask what mind is for, why do animals, including men, have minds? The biologist would say, in order that they may *adapt* themselves to their environment. Each individual from mollusc to man needs the amount and type of mind that serves to fit its possessor into its particular world of activity. Too little mind leaves the animal helpless in the struggle for existence. On the other hand a mind far above its possessor's station would prove useless if not a handicap; a mollusc could not use the mind of a man.

Content of Consciousness Determined by Function.—How much mind does man need? What range and type of consciousness will best serve to adjust us to our world of opportunity and responsibility? First of all we must *know* our world, hence, our mind must be capable of gathering knowledge. Second, we must be able to *feel* its values and respond to the great

motives for action arising from the emotions. Third, we must have the power to exert self-compulsion, which is to say that we possess a *will* to control our acts. These three sets of processes, *knowing*, *feeling*, and *willing*, we shall, therefore, expect to find making up the content of our mental stream.

Let us proceed at once to test our conclusion by introspection. If we are sitting at our study table puzzling over a difficult problem in geometry, *reasoning* forms the wave in the stream of consciousness—the center of the field. It is the chief thing in our thinking. The fringe of our consciousness is made up of various sensations of the light from the lamp, the contact of our clothing, the sounds going on in the next room, some bit of memory seeking recognition, a "tramp" thought which comes along, and a dozen other experiences not strong enough to occupy the center of the field.

But instead of the study table and the problem, give us a bright fireside, an easy-chair, and nothing to do. If we are aged, *memories*—images from out the past—will probably come thronging in and occupy the field to such extent that the fire burns low and the room grows cold, but still the forms from the past hold sway. If we are young, visions of the future may crowd everything else to the margin of the field, while the "castles in Spain" occupy the center.

Our memories may also be accompanied by emotions—sorrow, love, anger, hate, envy, joy. And, indeed, these emotions may so completely occupy the field that the images themselves

are for the time driven to the margin, and the mind is occupied with its sorrow, its love, or its joy.

Once more, instead of the problem or the memories or the "castles in Spain," give us the necessity of making some decision, great or small, where contending motives are pulling us now in this direction, now in that, so that the question finally has to be settled by a supreme effort summed up in the words, *I will*. This is the struggle of the will which each one knows for himself; for who has not had a raging battle of motives occupy the center of the field while all else, even the sense of time, place and existence, gave way in the face of this conflict! This struggle continues until the decision is made, when suddenly all the stress and strain drop out and other objects may again have place in consciousness.

The Three Fundamental Phases of Consciousness.—Thus we see that if we could cut the stream of consciousness across as we might cut a stream of water from bank to bank with a huge knife, and then look at the cut-off section, we should find very different constituents in the stream at different times. We should at one time find the mind manifesting itself in *perceiving*, *remembering*, *imagining*, *discriminating*, *comparing*, *judging*, *reasoning*, or the acts by which we gain our knowledge; at another in *fearing*, *loving*, *hating*, *sorrowing*, *enjoying*, or the acts of feeling; at still another in *choosing*, or the act of the will. These processes would make up the stream, or, in other words, these are the acts which the mind performs in doing its work.

We should never find a time when the stream consists of but one of the processes, or when all these modes of mental activity are not represented. They will be found in varying proportions, now more of knowing, now of feeling, and now of willing, but some of each is always present in our consciousness. The nature of these different elements in our mental stream, their relation to each other, and the manner in which they all work together in amazing perplexity yet in perfect harmony to produce the wonderful *mind*, will constitute the subject-matter we shall consider together in the pages which follow.

4. WHERE CONSCIOUSNESS RESIDES

I—the conscious self—dwell somewhere in this body, but where? When my finger tips touch the object I wish to examine, I seem to be in them. When the brain grows weary from overstudy, I seem to be in it. When the heart throbs, the breath comes quick, and the muscles grow tense from noble resolve or strong emotion, I seem to be in them all. When, filled with the buoyant life of vigorous youth, every fiber and nerve is a-tingle with health and enthusiasm, I live in every part of my marvelous body. Small wonder that the ancients located the soul at one time in the heart, at another in the pineal gland of the brain, and at another made it coextensive with the body!

Consciousness Works through the Nervous System.— Later science has taught that the *mind resides in and works through the nervous system, which has its central office in the brain*. And the reason why *I* seem to be in every part of my body is because the nervous system extends to every part, carrying messages of sight or sound or touch to the brain, and bearing in return orders for movements, which set the feet a-dancing or the fingers a-tingling. But more of this later.

This partnership between mind and body is very close. Just how it happens that spirit may inhabit matter we may not know. But certain it is that they interact on each other. What will

hinder the growth of one will handicap the other, and what favors the development of either will help both. The methods of their coöperation and the laws that govern their relationship will develop as our study goes on.

5. PROBLEMS IN OBSERVATION AND INTROSPECTION

One should always keep in mind that psychology is essentially a laboratory science, and not a text-book subject. The laboratory material is to be found in ourselves and in those about us. While the text should be thoroughly mastered, its statements should always be verified by reference to one's own experience, and observation of others. Especially should prospective teachers constantly correlate the lessons of the book with the observation of children at work in the school. The problems suggested for observation and introspection will, if mastered, do much to render practical and helpful the truths of psychology.

1. Think of your home as you last left it. Can you see vividly just how it looked, the color of the paint on the outside, with the familiar form of the roof and all; can you recall the perfume in some old drawer, the taste of a favorite dish, the sound of a familiar voice in farewell?

2. What illustrations have you observed where the mental content of the moment seemed chiefly *thinking* (knowledge process); chiefly *emotion* (feeling process); chiefly *choosing*, or self-compulsion (willing process)?

3. When you say that you remember a circumstance that occurred yesterday, how do you remember it? That is, do you see in your mind things just as they were, and hear again sounds

which occurred, or feel again movements which you performed? Do you experience once more the emotions you then felt?

4. What forms of expression most commonly reveal *thought*; what reveal emotions? (i.e., can you tell what a child is *thinking about* by the expression on his face? Can you tell whether he is *angry*, *frightened*, *sorry*, by his face? Is speech as necessary in expressing feeling as in expressing thought?)

5. Try occasionally during the next twenty-four hours to turn quickly about mentally and see whether you can observe your thinking, feeling, or willing in the very act of taking place.

6. What becomes of our mind or consciousness while we are asleep? How are we able to wake up at a certain hour previously determined? Can a person have absolutely *nothing* in his mind?

7. Have you noticed any children especially adept in expression? Have you noticed any very backward? If so, in what form of expression in each case?

8. Have you observed any instances of expression which you were at a loss to interpret (remember that "expression" includes every form of physical action, voice, speech, face, form, hand, etc.)?

CHAPTER II

ATTENTION

How do you rank in mental ability, and how effective are your mind's grasp and power? The answer that must be given to these questions will depend not more on your native endowment than on your skill in using attention.

1. NATURE OF ATTENTION

It is by attention that we gather and mass our mental energy upon the critical and important points in our thinking. In the last chapter we saw that consciousness is not distributed evenly over the whole field, but "piled up," now on this object of thought, now on that, in obedience to interest or necessity. *The concentration of the mind's energy on one object of thought is attention.*

The Nature of Attention.—Everyone knows what it is to attend. The story so fascinating that we cannot leave it, the critical points in a game, the interesting sermon or lecture, the sparkling conversation—all these compel our attention. So completely is our mind's energy centered on them and withdrawn from other things that we are scarcely aware of what is going on about us.

We are also familiar with another kind of attention. For we all have read the dull story, watched the slow game, listened to the lecture or sermon that drags, and taken part in conversation that was a bore. We gave these things our attention, but only with effort. Our mind's energy seemed to center on anything rather than the matter in hand. A thousand objects from outside enticed us away, and it required the frequent "mental jerk" to bring us to the subject in hand. And when brought back to our thought problem we felt the constant "tug" of mind to be free again.

Normal Consciousness Always in a State of Attention.—

But this very effort of the mind to free itself from one object of thought that it may busy itself with another is *because attention is solicited by this other*. Some object in our field of consciousness is always exerting an appeal for attention; and to attend *to* one thing is always to attend *away from* a multitude of other things upon which the thought might rest. We may therefore say that attention is constantly *selecting* in our stream of thought those aspects that are to receive emphasis and consideration. From moment to moment it determines the points at which our mental energy shall be centered.

2. THE EFFECTS OF ATTENTION

Attention Makes Its Object Clear and Definite.—Whatever attention centers upon stands out sharp and clear in consciousness. Whether it be a bit of memory, an "air-castle," a sensation from an aching tooth, the reasoning on an algebraic formula, a choice which we are making, the setting of an emotion —whatever be the object to which we are attending, that object is illumined and made to stand out from its fellows as the one prominent thing in the mind's eye while the attention rests on it. It is like the one building which the searchlight picks out among a city full of buildings and lights up, while the remainder are left in the semilight or in darkness.

Attention Measures Mental Efficiency.—In a state of attention the mind may be likened to the rays of the sun which have been passed through a burning glass. You may let all the rays which can pass through your window pane fall hour after hour upon the paper lying on your desk, and no marked effects follow. But let the same amount of sunlight be passed through a lens and converged to a point the size of your pencil point, and the paper will at once burst into flame. What the diffused rays could not do in hours or in ages is now accomplished in seconds. Likewise the mind, allowed to scatter over many objects, can accomplish but little. We may sit and dream away an hour or a day over a page or a problem without securing results. But let us call in our wits

from their wool-gathering and "buckle down to it" with all our might, withdrawing our thoughts from everything else but this *one thing*, and concentrating our mind on it. More can now be accomplished in minutes than before in hours. Nay, *things which could not be accomplished at all before* now become possible.

Again, the mind may be compared to a steam engine which is constructed to run at a certain pressure of steam, say one hundred and fifty pounds to the square inch of boiler surface. Once I ran such an engine; and well I remember a morning during my early apprenticeship when the foreman called for power to run some of the lighter machinery, while my steam gauge registered but seventy-five pounds. "Surely," I thought, "if one hundred and fifty pounds will run all this machinery, seventy-five pounds should run half of it," so I opened the valve. But the powerful engine could do but little more than turn its own wheels, and refused to do the required work. Not until the pressure had risen above one hundred pounds could the engine perform half the work which it could at one hundred and fifty pounds. And so with our mind. If it is meant to do its best work under a certain degree of concentration, it cannot in a given time do half the work with half the attention. Further, there will be much *which it cannot do at all* unless working under full pressure. We shall not be overstating the case if we say that as attention increases in arithmetical ratio, mental efficiency increases in geometrical ratio. It is in large measure a difference in the power of attention which makes one man a master in thought and achievement and

another his humble follower. One often hears it said that "genius is but the power of sustained attention," and this statement possesses a large element of truth.

3. HOW WE ATTEND

Someone has said that if our attention is properly trained we should be able "to look at the point of a cambric needle for half an hour without winking." But this is a false idea of attention. The ability to look at the point of a cambric needle for half an hour might indicate a very laudable power of concentration; but the process, instead of enlightening us concerning the point of the needle, would result in our passing into a hypnotic state. Voluntary attention to any one object can be sustained for but a brief time—a few seconds at best. It is essential that the object change, that we turn it over and over incessantly, and consider its various aspects and relations. Sustained voluntary attention is thus a repetition of successive efforts to bring back the object to the mind. Then the subject grows and develops—it is living, not dead.

Attention a Relating Activity.—When we are attending strongly to one object of thought it does not mean that consciousness sits staring vacantly at this one object, but rather that it uses it as a central core of thought, and thinks into relation with this object the things which belong with it. In working out some mathematical solution the central core is the principle upon which the solution is based, and concentration in this case consists in thinking the various conditions of the problem in relation to this underlying principle. In the accompanying

diagram (Fig. 4) let A be the central core of some object of thought, say a patch of cloud in a picture, and let *a*, *b*, *c*, *d*, etc., be the related facts, or the shape, size, color, etc., of the cloud. The arrows indicate the passing of our thought from cloud to related fact, or from related fact to cloud, and from related fact to related fact. As long as these related facts lead back to the cloud each time, that long we are attending to the cloud and thinking about it. It is when our thought fails to go back that we "wander" in our attention. Then we leave *a*, *b*, *c*, *d*, etc., which are related to the cloud, and, flying off to *x*, *y*, and *z,* finally bring up heaven knows where.

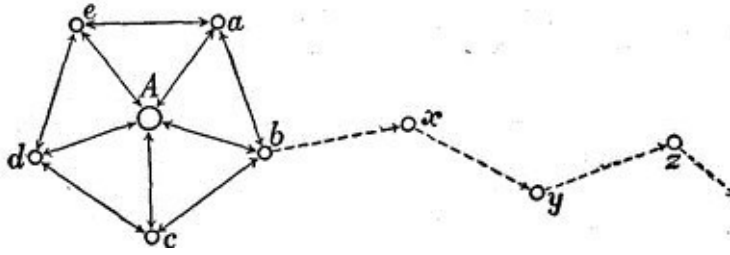

Fig. 4

The Rhythms of Attention.—Attention works in rhythms. This is to say that it never maintains a constant level of concentration for any considerable length of time, but regularly ebbs and flows. The explanation of this rhythmic action would take us too far afield at this point. When we remember, however,

that our entire organism works within a great system of rhythms —hunger, thirst, sleep, fatigue, and many others—it is easy to see that the same law may apply to attention. The rhythms of attention vary greatly, the fluctuations often being only a few seconds apart for certain simple sensations, and probably a much greater distance apart for the more complex process of thinking. The seeming variation in the sound of a distant waterfall, now loud and now faint, is caused by the rhythm of attention and easily allows us to measure the rhythm for this particular sensation.

4. POINTS OF FAILURE IN ATTENTION

Lack of Concentration.—There are two chief types of inattention whose danger threatens every person. *First*, we may be thinking about the right things, but not thinking *hard* enough. We lack mental pressure. Outside thoughts which have no relation to the subject in hand may not trouble us much, but we do not attack our problem with vim. The current in our stream of consciousness is moving too slowly. We do not gather up all our mental forces and mass them on the subject before us in a way that means victory. Our thoughts may be sufficiently focused, but they fail to "set fire." It is like focusing the sun's rays while an eclipse is on. They lack energy. They will not kindle the paper after they have passed through the lens. This kind of attention means mental dawdling. It means inefficiency. For the individual it means defeat in life's battles; for the nation it means mediocrity and stagnation.

A college professor said to his faithful but poorly prepared class, "Judging from your worn and tired appearance, young people, you are putting in twice too many hours on study." At this commendation the class brightened up visibly. "But," he continued, "judging from your preparation, you do not study quite half hard enough."

Happy is the student who, starting in on his lesson rested and

fresh, can study with such concentration that an hour of steady application will leave him mentally exhausted and limp. That is one hour of triumph for him, no matter what else he may have accomplished or failed to accomplish during the time. He can afford an occasional pause for rest, for difficulties will melt rapidly away before him. He possesses one key to successful achievement.

Mental Wandering.—*Second*, we may have good mental power and be able to think hard and efficiently on any one point, but lack the power to think in a straight line. Every stray thought that comes along is a "will-o'-the-wisp" to lead us away from the subject in hand and into lines of thought not relating to it. Who has not started in to think on some problem, and, after a few moments, been surprised to find himself miles away from the topic upon which he started! Or who has not read down a page and, turning to the next, found that he did not know a word on the preceding page, his thoughts having wandered away, his eyes only going through the process of reading! Instead of sticking to the *a*, *b*, *c*, *d*, etc., of our topic and relating them all up to A, thereby reaching a solution of the problem, we often jump at once to *x*, *y*, *z*, and find ourselves far afield with all possibility of a solution gone. We may have brilliant thoughts about *x*, *y*, *z*, but they are not related to anything in particular, and so they pass from us and are gone—lost in oblivion because they are not attached to something permanent.

Such a thinker is at the mercy of circumstances, following

blindly the leadings of trains of thought which are his master instead of his servant, and which lead him anywhere or nowhere without let or hindrance from him. His consciousness moves rapidly enough and with enough force, but it is like a ship without a helm. Starting for the intellectual port *A* by way of *a*, *b*, *c*, *d*, he is mentally shipwrecked at last on the rocks *x*, *y*, *z*, and never reaches harbor. Fortunate is he who can shut out intruding thoughts and think in a straight line. Even with mediocre ability he may accomplish more by his thinking than the brilliant thinker who is constantly having his mental train wrecked by stray thoughts which slip in on his right of way.

5. TYPES OF ATTENTION

The Three Types of Attention.—Attention may be secured in three ways: (1) It is demanded by some sudden or intense sensory stimulus or insistent idea, or (2) it follows interest, or (3) it is compelled by the will. If it comes in the first way, as from a thunderclap or a flash of light, or from the persistent attempt of some unsought idea to secure entrance into the mind, it is called *involuntary* attention. This form of attention is of so little importance, comparatively, in our mental life that we shall not discuss it further.

If attention comes in the second way, following interest, it is called *nonvoluntary* or spontaneous attention; if in the third, compelled by the will, *voluntary* or active attention. Nonvoluntary attention has its motive in some object external to consciousness, or else follows a more or less uncontrolled current of thought which interests us; voluntary attention is controlled from within—*we* decide what we shall attend to instead of letting interesting objects of thought determine it for us.

Interest and Nonvoluntary Attention.—In nonvoluntary attention the environment largely determines what we shall attend to. All that we have to do with directing this kind of attention is in developing certain lines of interest, and then the interesting things attract attention. The things we see and hear and touch and taste and smell, the things we like, the things we do

and hope to do—these are the determining factors in our mental life so long as we are giving nonvoluntary attention. Our attention follows the beckoning of these things as the needle the magnet. It is no effort to attend to them, but rather the effort would be to keep from attending to them. Who does not remember reading a story, perhaps a forbidden one, so interesting that when mother called up the stairs for us to come down to attend to some duty, we replied, "Yes, in a minute," and then went on reading! We simply could not stop at that place. The minute lengthens into ten, and another call startles us. "Yes, I'm coming;" we turn just one more leaf, and are lost again. At last comes a third call in tones so imperative that it cannot be longer ignored, and we lay the book down, but open to the place where we left off, and where we hope soon to begin further to unravel the delightful mystery. Was it an effort to attend to the reading? Ah, no! it took the combined force of our will and of mother's authority to drag the attention away. This is nonvoluntary attention.

Left to itself, then, attention simply obeys natural laws and follows the line of least resistance. By far the larger portion of our attention is of this type. Thought often runs on hour after hour when we are not conscious of effort or struggle to compel us to cease thinking about this thing and begin thinking about that. Indeed, it may be doubted whether this is not the case with some persons for days at a time, instead of hours. The things that present themselves to the mind are the things which occupy it; the character of the thought is determined by the character of

our interests. It is this fact which makes it vitally necessary that our interests shall be broad and pure if our thoughts are to be of this type. It is not enough that we have the strength to drive from our minds a wrong or impure thought which seeks entrance. To stand guard as a policeman over our thoughts to see that no unworthy one enters, requires too much time and energy. Our interests must be of such a nature as to lead us away from the field of unworthy thoughts if we are to be free from their tyranny.

The Will and Voluntary Attention.—In voluntary attention there is a conflict either between the will and interest or between the will and the mental inertia or laziness, which has to be overcome before we can think with any degree of concentration. Interest says, "Follow this line, which is easy and attractive, or which requires but little effort—follow the line of least resistance." Will says, "Quit that line of dalliance and ease, and take this harder way which I direct—cease the line of least resistance and take the one of greatest resistance." When day dreams and "castles in Spain" attempt to lure you from your lessons, refuse to follow; shut out these vagabond thoughts and stick to your task. When intellectual inertia deadens your thought and clogs your mental stream, throw it off and court forceful effort. If wrong or impure thoughts seek entrance to your mind, close and lock your mental doors to them. If thoughts of desire try to drive out thoughts of duty, be heroic and insist that thoughts of duty shall have right of way. In short, see that *you* are the master of your thinking, and do not let it always be directed

without your consent by influences outside of yourself.

It is just at this point that the strong will wins victory and the weak will breaks down. Between the ability to control one's thoughts and the inability to control them lies all the difference between right actions and wrong actions; between withstanding temptation and yielding to it; between an inefficient purposeless life and a life of purpose and endeavor; between success and failure. For we act in accordance with those things which our thought rests upon. Suppose two lines of thought represented by *A* and *B*, respectively, lie before you; that *A* leads to a course of action difficult or unpleasant, but necessary to success or duty, and that *B* leads to a course of action easy or pleasant, but fatal to success or duty. Which course will you follow—the rugged path of duty or the easier one of pleasure? The answer depends almost wholly, if not entirely, on your power of attention. If your will is strong enough to pull your thoughts away from the fatal but attractive *B* and hold them resolutely on the less attractive *A*, then *A* will dictate your course of action, and you will respond to the call for endeavor, self-denial, and duty; but if your thoughts break away from the domination of your will and allow the beckoning of your interests alone, then *B* will dictate your course of action, and you will follow the leading of ease and pleasure. *For our actions are finally and irrevocably dictated by the things we think about.*

Not Really Different Kinds of Attention.—It is not to be understood, however, from what has been said, that there

are *really* different kinds of attention. All attention denotes an active or dynamic phase of consciousness. The difference is rather *in the way we secure attention*; whether it is demanded by sudden stimulus, coaxed from us by interesting objects of thought without effort on our part, or compelled by force of will to desert the more interesting and take the direction which we dictate.

6. IMPROVING THE POWER OF ATTENTION

While attention is no doubt partly a natural gift, yet there is probably no power of the mind more susceptible to training than is attention. And with attention, as with every other power of body and mind, the secret of its development lies in its use. Stated briefly, the only way to train attention is by attending. No amount of theorizing or resolving can take the place of practice in the actual process of attending.

Making Different Kinds of Attention Reënforce Each Other.—A very close relationship and interdependence exists between nonvoluntary and voluntary attention. It would be impossible to hold our attention by sheer force of will on objects which were forever devoid of interest; likewise the blind following of our interests and desires would finally lead to shipwreck in all our lives. Each kind of attention must support and reënforce the other. The lessons, the sermons, the lectures, and the books in which we are most interested, and hence to which we attend nonvoluntarily and with the least effort and fatigue, are the ones out of which, other things being equal, we get the most and remember the best and longest. On the other hand, there are sometimes lessons and lectures and books, and many things besides, which are not intensely interesting, but which should be attended to nevertheless. It is at this point that

the will must step in and take command. If it has not the strength to do this, it is in so far a weak will, and steps should be taken to develop it. We are to "*keep the faculty of effort alive in us by a little gratuitous exercise every day*." We are to be systematically heroic in the little points of everyday life and experience. We are not to shrink from tasks because they are difficult or unpleasant. Then, when the test comes, we shall not find ourselves unnerved and untrained, but shall be able to stand in the evil day.

The Habit of Attention.—Finally, one of the chief things in training the attention is *to form the habit of attending*. This habit is to be formed only by *attending* whenever and wherever the proper thing to do is to attend, whether "in work, in play, in making fishing flies, in preparing for an examination, in courting a sweetheart, in reading a book." The lesson, or the sermon, or the lecture, may not be very interesting; but if they are to be attended to at all, our rule should be to attend to them completely and absolutely. Not by fits and starts, now drifting away and now jerking ourselves back, but *all the time*. And, furthermore, the one who will deliberately do this will often find the dull and uninteresting task become more interesting; but if it never becomes interesting, he is at least forming a habit which will be invaluable to him through life. On the other hand, the one who fails to attend except when his interest is captured, who never exerts effort to compel attention, is forming a habit which will be the bane of his thinking until his stream of thought shall end.

7. PROBLEMS IN OBSERVATION AND INTROSPECTION

1. Which fatigues you more, to give attention of the nonvoluntary type, or the voluntary? Which can you maintain longer? Which is the more pleasant and agreeable to give? Under which can you accomplish more? What bearing have these facts on teaching?

2. Try to follow for one or two minutes the "wave" in your consciousness, and then describe the course taken by your attention.

3. Have you observed one class alert in attention, and another lifeless and inattentive? Can you explain the causes lying back of this difference? Estimate the relative amount of work accomplished under the two conditions.

4. What distractions have you observed in the schoolroom tending to break up attention?

5. Have you seen pupils inattentive from lack of (1) change, (2) pure air, (3) enthusiasm on the part of the teacher, (4) fatigue, (5) ill health?

6. Have you noticed a difference in the *habit* of attention in different pupils? Have you noticed the same thing for whole schools or rooms?

7. Do you know of children too much given to daydreaming? Are you?

8. Have you seen a teacher rap the desk for attention? What type of attention was secured? Does it pay?

9. Have you observed any instance in which pupils' lack of attention should be blamed on the teacher? If so, what was the fault? The remedy?

10. Visit a school room or a recitation, and then write an account of the types and degrees of attention you observed. Try to explain the factors responsible for any failures in attention, and also those responsible for the good attention shown.

CHAPTER III

THE BRAIN AND NERVOUS SYSTEM

A fine brain, or a good mind. These terms are often used interchangeably, as if they stood for the same thing. Yet the brain is material substance—so many cells and fibers, a pulpy protoplasmic mass weighing some three pounds and shut away from the outside world in a casket of bone. The mind is a spiritual thing—the sum of the processes by which we think and feel and will, mastering our world and accomplishing our destiny.

1. THE RELATIONS OF MIND AND BRAIN

Interaction of Mind and Brain.—How, then, come these two widely different facts, mind and brain, to be so related in our speech? Why are the terms so commonly interchanged?—It is because mind and brain are so vitally related in their processes and so inseparably connected in their work. No movement of our thought, no bit of sensation, no memory, no feeling, no act of decision but is accompanied by its own particular activity in the cells of the brain. It is this that the psychologist has in mind when he says, *no psychosis without its corresponding neurosis*.

So far as our present existence is concerned, then, no mind ever works except through some brain, and a brain without a mind becomes but a mass of dead matter, so much clay. Mind and brain are perfectly adapted to each other. Nor is this mere accident. For through the ages of man's past history each has grown up and developed into its present state of efficiency by working in conjunction with the other. Each has helped form the other and determine its qualities. Not only is this true for the race in its evolution, but for every individual as he passes from infancy to maturity.

The Brain as the Mind's Machine.—In the first chapter we saw that the brain does not create the mind, but that the mind works through the brain. No one can believe that the brain

secretes mind as the liver secretes bile, or that it grinds it out as a mill does flour. Indeed, just what their exact relation is has not yet been settled. Yet it is easy to see that if the mind must use the brain as a machine and work through it, then the mind must be subject to the limitations of its machine, or, in other words, the mind cannot be better than the brain through which it operates. A brain and nervous system that are poorly developed or insufficiently nourished mean low grade of efficiency in our mental processes, just as a poorly constructed or wrongly adjusted motor means loss of power in applying the electric current to its work. We will, then, look upon the mind and the brain as counterparts of each other, each performing activities which correspond to activities in the other, both inextricably bound together at least so far as this life is concerned, and each getting its significance by its union with the other. This view will lend interest to a brief study of the brain and nervous system.

2. THE MIND'S DEPENDENCE ON THE EXTERNAL WORLD

But can we first see how in a general way the brain and nervous system are primarily related to our thinking? Let us go back to the beginning and consider the babe when it first opens its eyes on the scenes of its new existence. What is in its mind? What does it think about? Nothing. Imagine, if you can, a person born blind and deaf, and without the sense of touch, taste, or smell. Let such a person live on for a year, for five years, for a lifetime. What would he know? What ray of intelligence would enter his mind? What would he think about? All would be dark to his eyes, all silent to his ears, all tasteless to his mouth, all odorless to his nostrils, all touchless to his skin. His mind would be a blank. He would have no mind. He could not get started to think. He could not get started to act. He would belong to a lower scale of life than the tiny animal that floats with the waves and the tide in the ocean without power to direct its own course. He would be but an inert mass of flesh without sense or intelligence.

The Mind at Birth.—Yet this is the condition of the babe at birth. It is born practically blind and deaf, without definite sense of taste or smell. Born without anything to think about, and no way to get anything to think about until the senses wake up and furnish some material from the outside world. Born with all the mechanism of muscle and nerve ready to perform the

countless complex movements of arms and legs and body which characterize every child, he could not successfully start these activities without a message from the senses to set them going. At birth the child probably has only the senses of contact and temperature present with any degree of clearness; taste soon follows; vision of an imperfect sort in a few days; hearing about the same time, and smell a little later. The senses are waking up and beginning their acquaintance with the outside world.

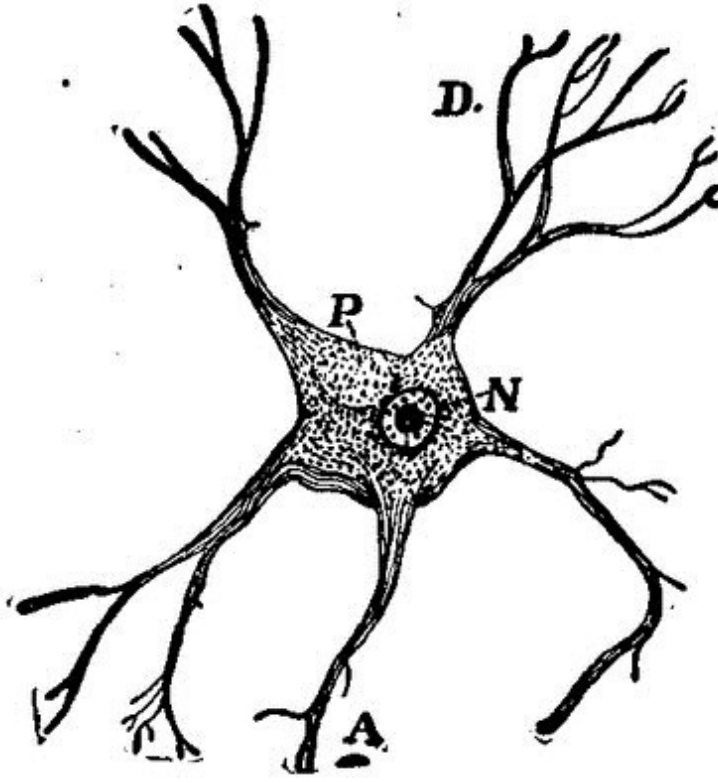

Fig. 5.—A Neurone from a Human Spinal Cord. The central portion represents the cell body. N, the nucleus; P, a pigmented or colored spot; D, a dendrite, or relatively short fiber,—which branches freely; A, an axon or long fiber, which branches but little.

The Work of the Senses.—And what a problem the senses have to solve! On the one hand the great universe of sights and sounds, of tastes and smells, of contacts and temperatures, and whatever else may belong to the material world in which we live; and on the other hand the little shapeless mass of gray and white pulpy matter called the brain, incapable of sustaining its own shape, shut away in the darkness of a bony case with no possibility of contact with the outside world, and possessing no means of communicating with it except through the senses. And yet this universe of external things must be brought into communication with the seemingly insignificant but really wonderful brain, else the mind could never be. Here we discover, then, the two great factors which first require our study if we would understand the growth of the mind—*the material world without, and the brain within*. For it is the action and interaction of these which lie at the bottom of the mind's development. Let us first look a little more closely at the brain and the accompanying nervous system.

3. STRUCTURAL ELEMENTS OF THE NERVOUS SYSTEM

It will help in understanding both the structure and the working of the nervous system to keep in mind that it contains *but one fundamental unit of structure*. This is the neurone. Just as the house is built up by adding brick upon brick, so brain, cord, nerves and organs of sense are formed by the union of numberless neurones.

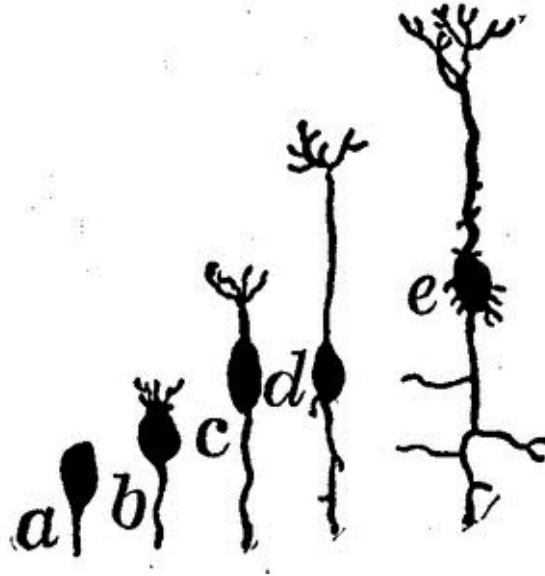

Fig. 6.—Neurones in different stages of development, from *a* to *e*. In *a*, the elementary cell body alone is present; in *c*, a dendrite is shown projecting upward and an axon downward.—After Donaldson.

The Neurone.—What, then, is a neurone? What is its structure, its function, how does it act? A neurone is *a protoplasmic cell, with its outgrowing fibers*. The cell part of the neurone is of a variety of shapes, triangular, pyramidal, cylindrical, and irregular. The cells vary in size from 1/250 to 1/3500 of an inch in diameter. In general the function of the cell

is thought to be to generate the nervous energy responsible for our consciousness—sensation, memory, reasoning, feeling and all the rest, and for our movements. The cell also provides for the nutrition of the fibers.

Fig. 7.—Longitudinal (A) and transverse (B) section of nerve fiber. The heavy border represents the medullary, or enveloping sheath, which becomes thicker in the larger fibers.—After Donaldson.

Neurone Fibers.—The neurone fibers are of two kinds, *dendrites* and *axons*. The dendrites are comparatively large in diameter, branch freely, like the branches of a tree, and extend but a relatively short distance from the parent cell. Axons are slender, and branch but little, and then approximately at right angles. They reach a much greater distance from the cell body than the dendrites. Neurones vary greatly in length. Some of those found in the spinal cord and brain are not more than 1/12 of an inch long, while others which reach from the extremities to the cord, measure several feet. Both dendrites and axons are of diameter so small as to be invisible except under the microscope.

Neuroglia.—Out of this simple structural element, the

neurone, the entire nervous system is built. True, the neurones are held in place, and perhaps insulated, by a kind of soft cement called *neuroglia*. But this seems to possess no strictly nervous function. The number of the microscopic neurones required to make up the mass of the brain, cord and peripheral nervous system is far beyond our mental grasp. It is computed that the brain and cord contain some 3,000 millions of them.

Complexity of the Brain.—Something of the complexity of the brain structure can best be understood by an illustration. Professor Stratton estimates that if we were to make a model of the human brain, using for the neurone fibers wires so small as to be barely visible to the eye, in order to find room for all the wires the model would need to be the size of a city block on the base and correspondingly high. Imagine a telephone system of this complexity operating from one switch-board!

"Gray" and "White" Matter.—The "gray matter" of the brain and cord is made up of nerve cells and their dendrites, and the terminations of axons, which enter from the adjoining white matter. A part of the mass of gray matter also consists of the neuroglia which surrounds the nerve cells and fibers, and a network of blood vessels. The "white matter" of the central system consists chiefly of axons with their enveloping or medullary, sheath and neuroglia. The white matter contains no nerve cells or dendrites. The difference in color of the gray and the white matter is caused chiefly by the fact that in the gray masses the medullary sheath, which is white, is lacking, thus

revealing the ashen gray of the nerve threads. In the white masses the medullary sheath is present.

4. GROSS STRUCTURE OF THE NERVOUS SYSTEM

Divisions of the Nervous System.—The nervous system may be considered in two divisions: (1) The *central* system, which consists of the brain and spinal cord, and (2) the *peripheral* system, which comprises the sensory and motor neurones connecting the periphery and the internal organs with the central system and the specialized end-organs of the senses. The *sympathetic* system, which is found as a double chain of nerve connections joining the roots of sensory and motor nerves just outside the spinal column, does not seem to be directly related to consciousness and so will not be discussed here. A brief description of the nervous system will help us better to understand how its parts all work together in so wonderful a way to accomplish their great result.

The Central System.—In the brain we easily distinguish three major divisions—the *cerebrum*, the *cerebellum* and the *medulla oblongata*. The medulla is but the enlarged upper part of the cord where it connects with the brain. It is about an inch and a quarter long, and is composed of both medullated and unmedullated fibers—that is of both "white" and "gray" matter. In the medulla, the unmedullated neurones which comprise the center of the cord are passing to the outside, and the medullated to the inside, thus taking the positions they occupy in the

cerebrum. Here also the neurones are crossing, or changing sides, so that those which pass up the right side of the cord finally connect with the left side of the brain, and vice versa.

The Cerebellum.—Lying just back of the medulla and at the rear part of the base of the cerebrum is the cerebellum, or "little brain," approximately as large as the fist, and composed of a complex arrangement of white and gray matter. Fibers from the spinal cord enter this mass, and others emerge and pass on into the cerebrum, while its two halves also are connected with each other by means of cross fibers.

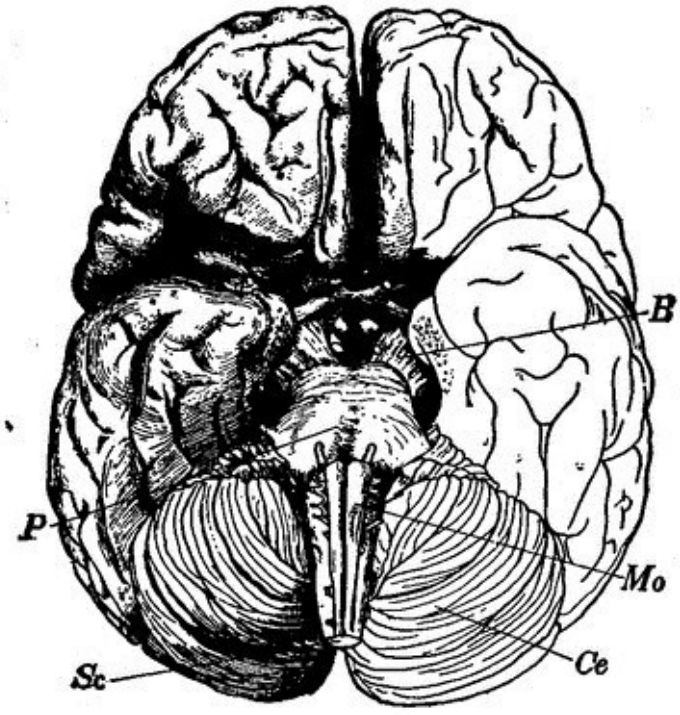

Fig. 8.—View of the under side of the brain. B, basis of the crura; P, pons; Mo, medulla oblongata; Ce, cerebellum; Sc, spinal cord.

The Cerebrum.—The cerebrum occupies all the upper part of the skull from the front to the rear. It is divided symmetrically into two hemispheres, the right and the left. These hemispheres

are connected with each other by a small bridge of fibers called the *corpus callosum*. Each hemisphere is furrowed and ridged with convolutions, an arrangement which allows greater surface for the distribution of the gray cellular matter over it. Besides these irregularities of surface, each hemisphere is marked also by two deep clefts or *fissures*—the fissure of Rolando, extending from the middle upper part of the hemisphere downward and forward, passing a little in front of the ear and stopping on a level with the upper part of it; and the fissure of Sylvius, beginning at the base of the brain somewhat in front of the ear and extending upward and backward at an acute angle with the base of the hemisphere.

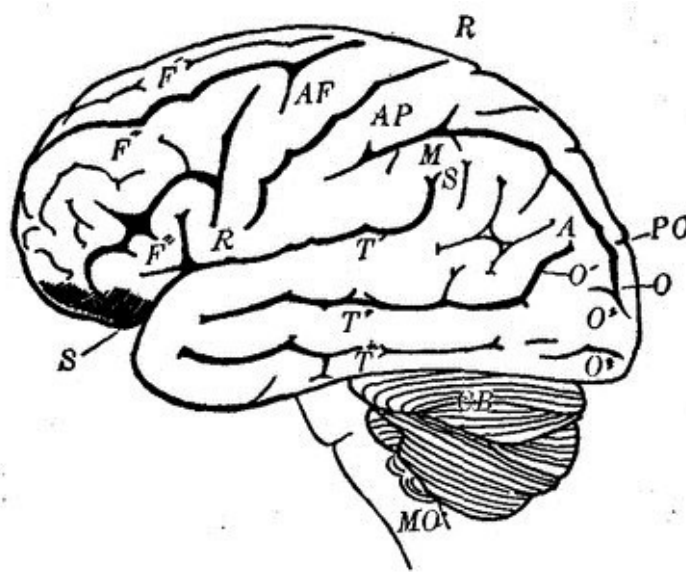

Fig. 9.—Diagrammatic side view of brain, showing cerebellum (CB) and medulla oblongata (MO). F' F'' F''' are placed on the first, second, and third frontal convolutions, respectively; AF, on the ascending frontal; AP, on the ascending parietal; M, on the marginal; A, on the angular. T' T'' T''' are placed on the first, second, and third temporal convolutions. R-R marks the fissure of Rolando; S-S, the fissure of Sylvius; PO, the parieto-occipital fissure.

The surface of each hemisphere may be thought of as mapped out into four lobes: The frontal lobe, which includes the front part

of the hemisphere and extends back to the fissure of Rolando and down to the fissure of Sylvius; the parietal lobe, which lies back of the fissure of Rolando and above that of Sylvius and extends back to the occipital lobe; the occipital lobe, which includes the extreme rear portion of the hemisphere; and the temporal lobe, which lies below the fissure of Sylvius and extends back to the occipital lobe.

The Cortex.—The gray matter of the hemispheres, unlike that of the cord, lies on the surface. This gray exterior portion of the cerebrum is called the *cortex*, and varies from one-twelfth to one-eighth of an inch in thickness. The cortex is the seat of all consciousness and of the control of voluntary movement.

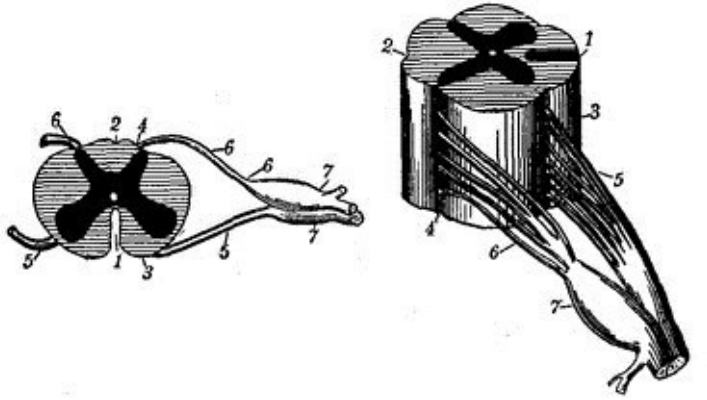

Fig. 10.—Different aspects of sections of the spinal cord and of the roots of the spinal nerves from the cervical region: 1, different views of anterior median fissure; 2, posterior fissure; 3,

anterior lateral depression for anterior roots; 4, posterior lateral depression for posterior roots; 5 and 6, anterior and posterior roots, respectively; 7, complete spinal nerve, formed by the union of the anterior and posterior roots.

The Spinal Cord.—The spinal cord proceeds from the base of the brain downward about eighteen inches through a canal provided for it in the vertebræ of the spinal column. It is composed of white matter on the outside, and gray matter within. A deep fissure on the anterior side and another on the posterior cleave the cord nearly in twain, resembling the brain in this particular. The gray matter on the interior is in the form of two crescents connected by a narrow bar.

The *peripheral* nervous system consists of thirty-one pairs of *nerves*, with their end-organs, branching off from the cord, and twelve pairs that have their roots in the brain. Branches of these forty-three pairs of nerves reach to every part of the periphery of the body and to all the internal organs.

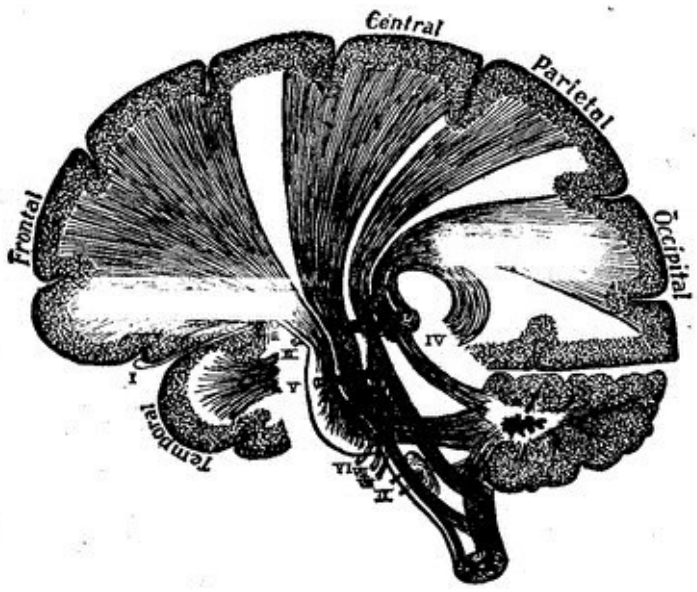

Fig. 11.—The projection fibers of the brain. I-IX, the first nine pairs of cranial nerves.

It will help in understanding the peripheral system to remember that a *nerve* consists of a bundle of neurone fibers each wrapped in its medullary sheath and sheath of Schwann. Around this bundle of neurones, that is around the nerve, is still another wrapping, silvery-white, called the neurilemma. The number of fibers going to make up a nerve varies from about 5,000 to 100,000. Nerves can easily be identified in a piece of lean beef, or even at the edge of a serious gash in one's own flesh!

Bundles of sensory fibers constituting a sensory nerve root enter the spinal cord on the posterior side through holes in the vertebræ. Similar bundles of motor fibers in the form of a motor nerve root emerge from the cord at the same level. Soon after their emergence from the cord, these two nerves are wrapped together in the same sheath and proceed in this way to the periphery of the body, where the sensory nerve usually ends in a specialized *end-organ* fitted to respond to some certain stimulus from the outside world. The motor nerve ends in minute filaments in the muscular organ which it governs. Both sensory and motor nerves connect with fibers of like kind in the cord and these in turn with the cortex, thus giving every part of the periphery direct connection with the cortex.

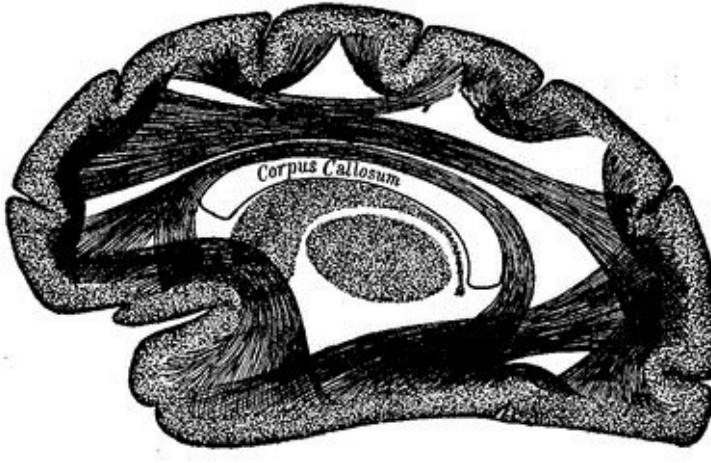

Fig. 12.—Schematic diagram showing association fibers connecting cortical centers with each other.—After James and Starr.

The *end-organs* of the sensory nerves are nerve masses, some of them, as the taste buds of the tongue, relatively simple; and others, as the eye or ear, very complex. They are all alike in one particular; namely, that each is fitted for its own particular work and can do no other. Thus the eye is the end-organ of sight, and is a wonderfully complex arrangement of nerve structure combined with refracting media, and arranged to respond to the rapid ether waves of light. The ear has for its essential part the specialized endings of the auditory nerve, and is fitted to respond to the waves carried to it in the air, giving the sensation of sound. The end-organs of touch, found in greatest perfection in the finger tips, are of several kinds, all very complicated in structure. And so on with each of the senses. Each particular sense has some form of end-organ specially adapted to respond to the kind of stimulus upon which its sensation depends, and each is insensible to the stimuli of the others, much as the receiver of a telephone will respond to the tones of our voice, but not to the touch of our fingers as will the telegraph instrument, and *vice versa*. Thus the eye is not affected by sounds, nor touch by light. Yet by means of all the senses together we are able to come in contact with the material world in a variety of ways.

5. LOCALIZATION OF FUNCTION IN THE NERVOUS SYSTEM

Division of Labor.—Division of labor is the law in the organic world as in the industrial. Animals of the lowest type, such as the amœba, do not have separate organs for respiration, digestion, assimilation, elimination, etc., the one tissue performing all of these functions. But in the higher forms each organ not only has its own specific work, but even within the same organ each part has its own particular function assigned. Thus we have seen that the two parts of the neurone probably perform different functions, the cells generating energy and the fibers transmitting it.

It will not seem strange, then, that there is also a division of labor in the cellular matter itself in the nervous system. For example, the little masses of ganglia which are distributed at intervals along the nerves are probably for the purpose of reënforcing the nerve current, much as the battery cells in the local telegraph office reënforce the current from the central office. The cellular matter in the spinal cord and lower parts of the brain has a very important work to perform in receiving messages from the senses and responding to them in directing the simpler reflex acts and movements which we learn to execute without our consciousness being called upon, thus leaving the mind free from these petty things to busy itself in higher ways.

The cellular matter of the cortex performs the highest functions of all, for through its activity we have consciousness.

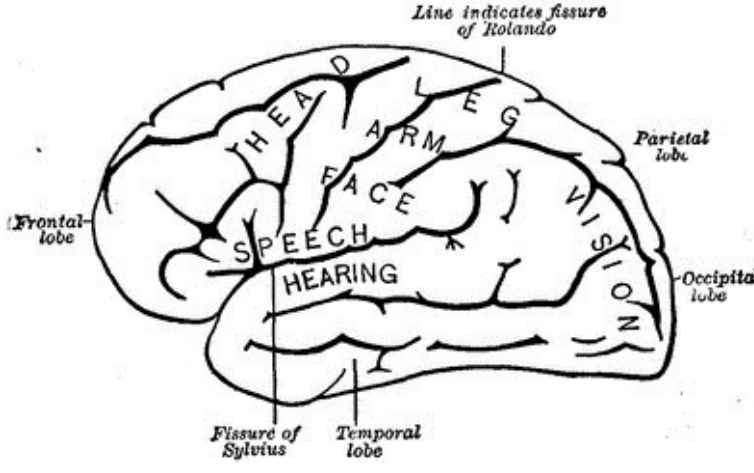

Fig. 13.—Side view of left hemisphere of human brain, showing the principal localized areas.

The gray matter of the cerebellum, the medulla, and the cord may receive impressions from the senses and respond to them with movements, but their response is in all cases wholly automatic and unconscious. A person whose hemispheres had been injured in such a way as to interfere with the activity of the cortex might still continue to perform most if not all of the habitual movements of his life, but they would be mechanical and not intelligent. He would lack all higher consciousness. It

is through the activity of this thin covering of cellular matter of the cerebrum, the *cortex*, that our minds operate; here are received stimuli from the different senses, and here sensations are experienced. Here all our movements which are consciously directed have their origin. And here all our thinking, feeling, and willing are done.

Division of Labor in the Cortex.—Nor does the division of labor in the nervous system end with this assignment of work. The cortex itself probably works essentially as a unit, yet it is through a shifting of tensions from one area to another that it acts, now giving us a sensation, now directing a movement, and now thinking a thought or feeling an emotion. Localization of function is the rule here also. Certain areas of the cortex are devoted chiefly to sensations, others to motor impulses, and others to higher thought activities, yet in such a way that all work together in perfect harmony, each reënforcing the other and making its work significant. Thus the front portion of the cortex seems to be devoted to the higher thought activities; the region on both sides of the fissure of Rolando, to motor activities; and the rear and lower parts to sensory activities; and all are bound together and made to work together by the association fibers of the brain.

In the case of the higher thought activities, it is not probable that one section of the frontal lobes of the cortex is set apart for thinking, one for feeling, and one for willing, etc., but rather that the whole frontal part of the cortex is concerned in each. In the

motor and sensory areas, however, the case is different; for here a still further division of labor occurs. For example, in the motor region one small area seems connected with movements of the head, one with the arm, one with the leg, one with the face, and another with the organs of speech; likewise in the sensory region, one area is devoted to vision, one to hearing, one to taste and smell, and one to touch, etc. We must bear in mind, however, that these regions are not mapped out as accurately as are the boundaries of our states—that no part of the brain is restricted wholly to either sensory or motor nerves, and that no part works by itself independently of the rest of the brain. We name a tract from the predominance of nerves which end there, or from the chief functions which the area performs. The motor localization seems to be the most perfect. Indeed, experimentation on the brains of monkeys has been successful in mapping out motor areas so accurately that such small centers as those connected with the bending of one particular leg or the flexing of a thumb have been located. Yet each area of the cortex is so connected with every other area by the millions of association fibers that the whole brain is capable of working together as a unit, thus unifying and harmonizing our thoughts, emotions, and acts.

6. FORMS OF SENSORY STIMULI

Let us next inquire how this mechanism of the nervous system is acted upon in such a way as to give us sensations. In order to understand this, we must first know that all forms of matter are composed of minute atoms which are in constant motion, and by imparting this motion to the air or the ether which surrounds them, are constantly radiating energy in the form of minute waves throughout space. These waves, or radiations, are incredibly rapid in some instances and rather slow in others. In sending out its energy in the form of these waves, the physical world is doing its part to permit us to form its acquaintance. The end-organs of the sensory nerves must meet this advance half-way, and be so constructed as to be affected by the different forms of energy which are constantly beating upon them.

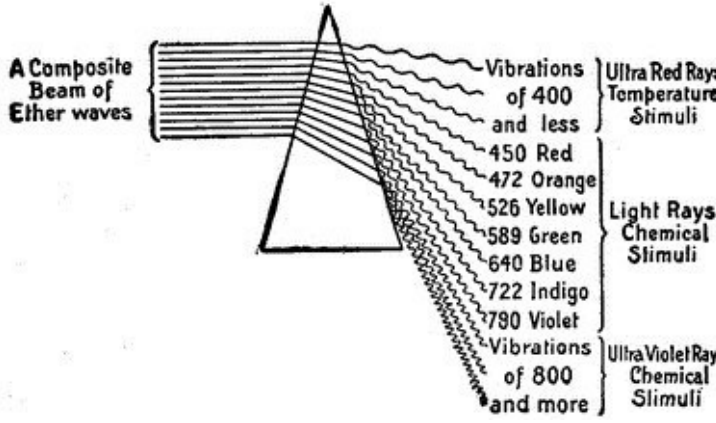

Fig. 14.—The prism's analysis of a bundle of light rays. On the right are shown the relation of vibration rates to temperature stimuli, to light and to chemical stimuli. The rates are given in billions per second.—After Witmer.

The End-organs and Their Response to Stimuli.—Thus the radiations of ether from the sun, our chief source of light, are so rapid that billions of them enter the eye in a second of time, and the retina is of such a nature that its nerve cells are thrown into activity by these waves; the impulse is carried over the optic nerve to the occipital lobe of the cortex, and the sensation of sight is the result. The different colors also, from the red of the spectrum to the violet, are the result of different vibration rates in the waves of ether which strike the retina; and in order to perceive color, the retina must be able to respond to the

particular vibration rate which represents each color. Likewise in the sense of touch the end-organs are fitted to respond to very rapid vibrations, and it is possible that the different qualities of touch are produced by different vibration rates in the atoms of the object we are touching. When we reach the ear, we have the organ which responds to the lowest vibration rate of all, for we can detect a sound made by an object which is vibrating from twenty to thirty times a second. The highest vibration rate which will affect the ear is some forty thousand per second.

Thus it is seen that there are great gaps in the different rates to which our senses are fitted to respond—a sudden drop from billions in the case of the eye to millions in touch, and to thousands or even tens in hearing. This makes one wonder whether there are not many things in nature which man has never discovered simply because he has not the sense mechanism enabling him to become conscious of their existence. There are undoubtedly "more things in heaven and earth than are dreamt of in our philosophy."

Dependence of the Mind on the Senses.—Only as the senses bring in the material, has the mind anything with which to build. Thus have the senses to act as messengers between the great outside world and the brain; to be the servants who shall stand at the doorways of the body—the eyes, the ears, the finger tips—each ready to receive its particular kind of impulse from nature and send it along the right path to the part of the cortex where it belongs, so that the mind can say, "A sight," "A

sound," or "A touch." Thus does the mind come to know the universe of the senses. Thus does it get the material out of which memory, imagination, and thought begin. Thus and only thus does the mind secure the crude material from which the finished superstructure is finally built.

CHAPTER IV

MENTAL DEVELOPMENT AND MOTOR TRAINING

Education was long looked upon as affecting the mind only; the body was either left out of account or neglected. Later science has shown, however, that the mind cannot be trained *except as the nervous system is trained and developed*. For not sensation and the simpler mental processes alone, but memory, imagination, judgment, reasoning and every other act of the mind are dependent on the nervous system finally for their efficiency. The little child gets its first mental experiences in connection with certain movements or acts set up reflexly by the pre-organized nervous system. From this time on movement and idea are so inextricably bound together that they cannot be separated. The mind and the brain are so vitally related that it is impossible to educate one without performing a like office for the other; and it is likewise impossible to neglect the one without causing the other to suffer in its development.

1. FACTORS DETERMINING THE EFFICIENCY OF THE NERVOUS SYSTEM

Development and Nutrition.—Ignoring the native differences in nervous systems through the influence of heredity, the efficiency of a nervous system is largely dependent on two factors: (1) The development of the cells and fibers of which it is composed, and (2) its general tone of health and vigor. The actual number of cells in the nervous system increases but little if at all after birth. Indeed, it is doubtful whether Edison's brain and nervous system has a greater number of cells in it than yours or mine. The difference between the brain of a genius and that of an ordinary man is not in the *number* of cells which it contains, but rather in the development of the cells and fibers which are present, potentially, at least, in every nervous system. The histologist tells us that in the nervous system of every child there are tens of thousands of cells which are so immature and undeveloped that they are useless; indeed, this is the case to some degree in every adult person's nervous system as well. Thus each individual has inherent in his nervous system potentialities of which he has never taken advantage, the utilizing of which may make him a genius and the neglecting of which will certainly leave him on the plane of mediocrity. The first problem in

education, then, is to take the unripe and inefficient nervous system and so develop it in connection with the growing mind that the possibilities which nature has stored in it shall become actualities.

Undeveloped Cells.—Professor Donaldson tells us on this point that: "At birth, and for a long time after, many [nervous] systems contain cell elements which are more or less immature, not forming a functional part of the tissue, and yet under some conditions capable of further development.... For the cells which are continually appearing in the developing cortex no other source is known than the nuclei or granules found there in its earliest stages. These elements are metamorphosed neuroblasts—that is, elementary cells out of which the nervous matter is developed—which have shrunken to a volume less than that which they had at first, and which remain small until, in the subsequent process of enlargement necessary for their full development, they expand into well-marked cells. Elements intermediate between these granules and the fully developed cells are always found, even in mature brains, and therefore it is inferred that the latter are derived from the former. The appearances there also lead to the conclusion that many elements which might possibly develop in any given case are far beyond the number that actually does so.... The possible number of cells latent and functional in the central system is early fixed. At any age this number is accordingly represented by the granules as well as by the cells which have already undergone further

development. During growth the proportion of developed cells increases, and sometimes, owing to the failure to recognize potential nerve cells in the granules, the impression is carried away that this increase implies the formation of new elements. As has been shown, such is not the case."[1]

Development of Nerve Fibers.—The nerve *fibers*, no less than the cells, must go through a process of development. It has already been shown that the fibers are the result of a branching of cells. At birth many of the cells have not yet thrown out branches, and hence the fibers are lacking; while many of those which are already grown out are not sufficiently developed to transmit impulses accurately. Thus it has been found that most children at birth are able to support the weight of the body for several seconds by clasping the fingers around a small rod, but it takes about a year for the child to become able to stand. It is evident that it requires more actual strength to cling to a rod than to stand; hence the conclusion is that the difference is in the earlier development of the nerve centers which have to do with clasping than of those concerned in standing. Likewise the child's first attempts to feed himself or do any one of the thousand little things about which he is so awkward, are partial failures not so much because he has not had practice as because his nervous machinery connected with those movements is not yet developed sufficiently to enable him to be accurate. His brain is in a condition which Flechsig calls "unripe." How, then, shall the

[1] Donaldson, "The Growth of the Brain," pp. 74, 238.

undeveloped cells and system ripen? How shall the undeveloped cells and fibers grow to full maturity and efficiency?

2. DEVELOPMENT OF NERVOUS SYSTEM THROUGH USE

Importance of Stimulus and Response.—Like all other tissues of the body, the nerve cells and fibers are developed by judicious use. The sensory and association centers require the constant stimulus of nerve currents running in from the various end-organs, and the motor centers require the constant stimulus of currents running from them out to the muscles. In other words, the conditions upon which both motor and sensory development depend are: (1) A rich environment of sights and sounds and tastes and smells, and everything else which serves as proper stimulus to the sense organs, and to every form of intellectual and social interest; and (2) no less important, an opportunity for the freest and most complete forms of response and motor activity.

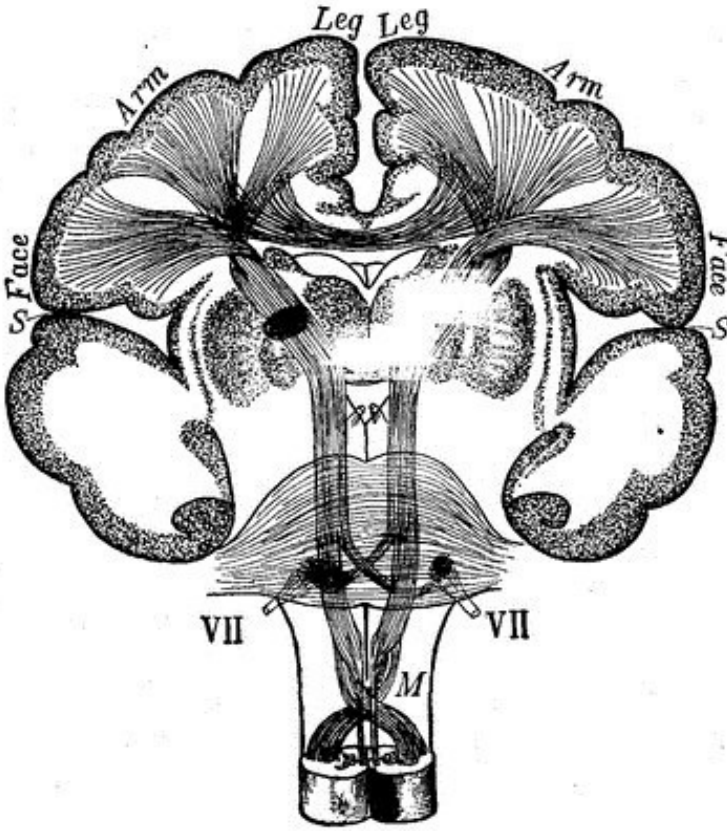

Fig. 15.—Schematic transverse section of the human brain showing the projection of the motor fibers, their crossing in the neighborhood of the medulla, and their termination in the different areas of localized function in the cortex. S, fissure of Sylvius; M, the medulla; VII, the roots of the facial nerves.

An illustration of the effects of the lack of sensory stimuli on the cortex is well shown in the case of Laura Bridgman, whose brain was studied by Professor Donaldson after her death. Laura Bridgman was born a normal child, and developed as other children do up to the age of nearly three years. At this time, through an attack of scarlet fever, she lost her hearing completely and also the sight of her left eye. Her right eye was so badly affected that she could see but little; and it, too, became entirely blind when she was eight. She lived in this condition until she was sixty years old, when she died. Professor Donaldson submitted the cortex of her brain to a most careful examination, also comparing the corresponding areas on the two hemispheres with each other. He found that as a whole the cortex was thinner than in the case of normal individuals. He found also that the cortical area connected with the left eye—namely, the right occipital region—was much thinner than that for the right eye, which had retained its sight longer than the other. He says: "It is interesting to notice that those parts of the cortex which, according to the current view, were associated with the defective sense organs were also particularly thin. The cause of this thinness was found to be due, at least in part, to the small size of the nerve cells there present. Not only were the large and medium-sized cells smaller, but the impression made on the observer was that they were also less numerous than in the normal cortex."

Effect of Sensory Stimuli.—No doubt if we could examine

the brain of a person who has grown up in an environment rich in stimuli to the eye, where nature, earth, and sky have presented a changing panorama of color and form to attract the eye; where all the sounds of nature, from the chirp of the insect to the roar of the waves and the murmur of the breeze, and from the softest tones of the voice to the mightiest sweep of the great orchestra, have challenged the ear; where many and varied odors and perfumes have assailed the nostrils; where a great range of tastes have tempted the palate; where many varieties of touch and temperature sensations have been experienced—no doubt if we could examine such a brain we should find the sensory areas of the cortex excelling in thickness because its cells were well developed and full sized from the currents which had been pouring into them from the outside world. On the other hand, if we could examine a cortex which had lacked any one of these stimuli, we should find some area in it undeveloped because of this deficiency. Its owner therefore possesses but the fraction of a brain, and would in a corresponding degree find his mind incomplete.

Necessity for Motor Activity.—Likewise in the case of the motor areas. Pity the boy or girl who has been deprived of the opportunity to use every muscle to the fullest extent in the unrestricted plays and games of childhood. For where such activities are not wide in their scope, there some areas of the cortex will remain undeveloped, because unused, and the person will be handicapped later in his life from lack of

skill in the activities depending on these centers. Halleck says in this connection: "If we could examine the developing motor region with a microscope of sufficient magnifying power, it is conceivable that we might learn wherein the modification due to exercise consists. We might also, under such conditions, be able to say, 'This is the motor region of a piano player; the modifications here correspond precisely to those necessary for controlling such movements of the hand.' Or, 'This is the motor tract of a blacksmith; this, of an engraver; and these must be the cells which govern the vocal organs of an orator.'" Whether or not the microscope will ever reveal such things to us, there is no doubt that the conditions suggested exist, and that back of every inefficient and awkward attempt at physical control lies a motor area with its cells undeveloped by use. No wonder that our processes of learning physical adjustment and control are slow, for they are a growth in the brain rather than a simple "learning how."

The training of the nervous system consists finally, then, in the development and coördination of the neurones of which it is composed. We have seen that the sensory cells are to be developed by the sensory stimuli pouring in upon them, and the motor cells by the motor impulses which they send out to the muscles. The sensory and the motor fibers likewise, being an outgrowth of their respective cells, find their development in carrying the impulses which result in sensation and movement. Thus it is seen that the neurone is, in its development as in its

work, a unit.

Development of the Association Centers.—To this simpler type of sensory and motor development which we have been considering, we must add that which comes from the more complex mental processes, such as memory, thought, and imagination. For it is in connection with these that the association fibers are developed, and the brain areas so connected that they can work together as a unit. A simple illustration will enable us to see more clearly how the nervous mechanism acts to bring this about.

Suppose that I am walking along a country road deeply engaged in meditation, and that I come to a puddle of water in my pathway. I may turn aside and avoid the obstruction without my attention being called to it, and without interruption of my train of thought. The act has been automatic. In this case the nerve current has passed from the eye (*S*) over an afferent fiber to a sensory center (*s*) in the nervous system below the cortex; from there it has been forwarded to a motor center (*m*) in the same region, and on out over a motor fiber to the proper muscles (*M*), which are to execute the required act. The act having been completed, the sensory nerves connected with the muscles employed report the fact back that the work is done, thus completing the circuit. This event may be taken as an illustration of literally thousands of acts which we perform daily without the intervention of consciousness, and hence without involving the hemispheres.

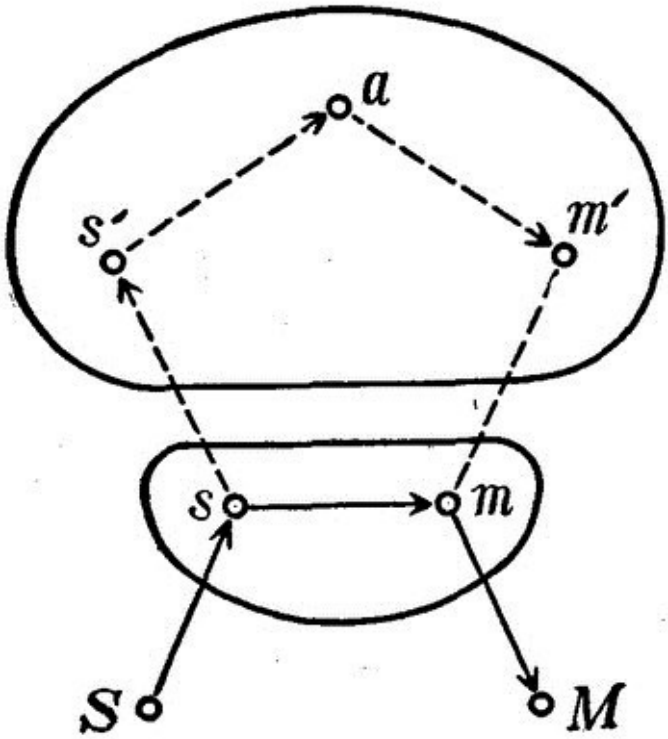

Fig. 16.—Diagram illustrating the paths of association.

If, however, instead of avoiding the puddle unconsciously, I do so from consideration of the danger of wet feet and the disagreeableness of soiled shoes and the ridiculous appearance I shall make, then the current cannot take the short circuit, but

must pass on up to the cortex. Here it awakens consciousness to take notice of the obstruction, and calls forth the images which aid in directing the necessary movements. This simple illustration may be greatly complicated, substituting for it one of the more complex problems which are continually presenting themselves to us for solution, or the associated trains of thought that are constantly occupying our minds. But the truth of the illustration still holds. Whether in the simple or the complex act, there is always a forward passing of the nerve current through the sensory and thought centers, and on out through the motor centers to the organs which are to be concerned in the motor response.

The Factors Involved in a Simple Action.—Thus it will be seen that in the simplest act which can be considered there are the following factors: (1) The stimulus which acts on the end-organ; (2) the ingoing current over an afferent nerve; (3) the sensory or interpreting cells; (4) the fibers connecting the sensory with a motor center; (5) the motor cells; (6) the efferent nerve to carry the direction for the movement outward to the muscle; (7) the motor response; and, finally, (8) the report back that the act has been performed. With this in mind it fairly bewilders one to think of the marvelous complexity of the work that is going on in our nervous mechanism every moment of our life, even without considering the higher thought processes at all. How, with these added, the resulting complexity all works out into beautiful harmony is indeed beyond comprehension.

3. EDUCATION AND THE TRAINING OF THE NERVOUS SYSTEM

Fortunately, many of the best opportunities for sensory and motor training do not depend on schools or courses of study. The world is full of stimuli to our senses and to our social natures; and our common lives are made up of the responses we make to these stimuli,—the movements, acts and deeds by which we fit ourselves into our world of environment. Undoubtedly the most rapid and vital progress we make in our development is accomplished in the years before we have reached the age to go to school. Yet it is the business of education to see that we do not lack any essential opportunity, to make sure that necessary lines of stimuli or of motor training have not been omitted from our development.

Education to Supply Opportunities for Stimulus and Response.—The great problem of education is, on the physical side, it would seem, then, to provide for ourselves and those we seek to educate as rich an environment of sensory and social stimuli as possible; one whose impressions will be full of suggestions to response in motor activity and the higher thought processes; and then to give opportunity for thought and for expression in acts and deeds in the largest possible number of lines. And added to this must be frequent and clear sensory and motor recall, a living over again of the sights and sounds and

odors and the motor activities we have once experienced. There must also be the opportunity for the forming of worthy plans and ideals. For in this way the brain centers which were concerned in the original sensation or thought or movement are again brought into exercise, and their development continued. Through recall and imagination we are able not only greatly to multiply the effects of the immediate sensory and motor stimuli which come to us, but also to improve our power of thinking by getting a fund of material upon which the mind can draw.

Order of Development in the Nervous System.—Nature has set the order in which the powers of the nervous system shall develop. And we must follow this order if we would obtain the best results. Stated in technical terms, the order is *from fundamental to accessory*. This is to say that the nerve centers controlling the larger and more general movements of the body ripen first, and those governing the finer motor adjustments later. For example, the larger body muscles of the child which are concerned with sitting up come under control earlier than those connected with walking. The arm muscles develop control earlier than the finger muscles, and the head and neck muscles earlier than the eye muscles. So also the more general and less highly specialized powers of the mind ripen sooner than the more highly specialized. Perception and observation precede powers of critical judgment and association. Memory and imagination ripen earlier than reasoning and the logical ability.

This all means that our educational system must be planned

to follow the order of nature. Children of the primary grades should not be required to write with fine pencils or pens which demand delicate finger adjustments, since the brain centers for these finer coördinations are not yet developed. Young children should not be set at work necessitating difficult eye control, such as stitching through perforated cardboard, reading fine print and the like, as their eyes are not yet ready for such tasks. The more difficult analytical problems of arithmetic and relations of grammar should not be required of pupils at a time when the association areas of the brain are not yet ready for this type of thinking. For such methods violate the law of nature, and the child is sure to suffer the penalty.

4. IMPORTANCE OF HEALTH AND VIGOR OF THE NERVOUS SYSTEM

Parallel with opportunities for proper stimuli and response the nervous system must possess good *tonicity*, or vigor. This depends in large degree on general health and nutrition, with freedom from overfatigue. No favorableness of environment nor excellence of training can result in an efficient brain if the nerve energy has run low from depleted health, want of proper nourishment, or exhaustion.

The Influence of Fatigue.—Histologists find that the nuclei of nerve cells are shrunk as much as fifty per cent by extreme fatigue. Reasonable fatigue followed by proper recuperation is not harmful, but even necessary if the best development is to be attained; but fatigue without proper nourishment and rest is fatal to all mental operations, and indeed finally to the nervous system itself, leaving it permanently in a condition of low tone, and incapable of rallying to strong effort. For rapid and complete recuperation the cells must have not only the best of nourishment but opportunity for rest as well.

Extreme and long-continued fatigue is hostile to the development and welfare of any nervous system, and especially to that of children. Not only does overfatigue hinder growth, but it also results in the formation of certain *toxins*, or poisons, in the organism, which are particularly harmful to nervous tissue. It

is these fatigue toxins that account for many of the nervous and mental disorders which accompany breakdowns from overwork. On the whole, the evil effects from mental overstrain are more to be feared than from physical overstrain.

The Effects of Worry.—There is, perhaps, no greater foe to brain growth and efficiency than the nervous and worn-out condition which comes from loss of sleep or from worry. Experiments in the psychological laboratories have shown that nerve cells shrivel up and lose their vitality under loss of sleep. Let this go on for any considerable length of time, and the loss is irreparable; for the cells can never recuperate. This is especially true in the case of children or young people. Many school boys and girls, indeed many college students, are making slow progress in their studies not because they are mentally slow or inefficient, not even chiefly because they lose time that should be put on their lessons, but because they are incapacitating their brains for good service through late hours and the consequent loss of sleep. Add to this condition that of worry, which often accompanies it from the fact of failure in lessons, and a naturally good and well-organized nervous system is sure to fail. Worry, from whatever cause, should be avoided as one would avoid poison, if we would bring ourselves to the highest degree of efficiency. Not only does worry temporarily unfit the mind for its best work, but its evil results are permanent, since the mind is left with a poorly developed or undone nervous system through which to work, even after the cause for worry has been removed

and the worry itself has ceased.

Not only should each individual seek to control the causes of worry in his own life, but the home and the school should force upon childhood as few causes for worry as may be. Children's worry over fears of the dark, over sickness and death, over prospective but delayed punishment, over the thousand and one real or imaginary troubles of childhood, should be eliminated so far as possible. School examinations that prey on the peace of mind, threats of failure of promotion, all nagging and sarcasm, and whatever else may cause continued pain or worry to sensitive minds should be barred from our schoolroom methods and practice. The price we force the child to pay for results through their use is too great for them to be tolerated. We must seek a better way.

The Factors in Good Nutrition.—For the best nutrition there is necessity first of all plenty of nourishing and healthful food. Science and experience have both disproved the supposition that students should be scantily fed. O'Shea claims that many brain workers are far short of their highest grade of efficiency because of starving their brains from poor diet. And not only must the food be of the right quality, but the body must be in good health. Little good to eat the best of food unless it is being properly digested and assimilated. And little good if all the rest is as it should be, and the right amount of oxidation does not go on in the brain so as to remove the worn-out cells and make place for new ones. This warns us that pure air and a strong

circulation are indispensable to the best working of our brains. No doubt many students who find their work too hard for them might locate the trouble in their stomachs or their lungs or the food they eat, rather than in their minds.

5. PROBLEMS FOR INTROSPECTION AND OBSERVATION

1. Estimate the mental progress made by the child during the first five years and compare with that made during the second five years of its life. To do this make a list, so far as you are able, of the acquisitions of each period. What do you conclude as to the importance of play and freedom in early education? Why not continue this method instead of sending the child to school?

2. Which has the better opportunity for sensory training, the city child or the country child? For social training? For motor development through play? It is said by specialists that country children are not as good players as city children. Why should this be the case?

3. Observe carefully some group of children for evidences of lack of sensory training (Interest in sensory objects, skill in observation, etc.). For lack of motor training (Failure in motor control, awkwardness, lack of skill in play, etc.). Do you find that general mental ability seems to be correlated with sensory and motor ability, or not?

4. What sensory training can be had from (1) geography, (2) agriculture, (3) arithmetic, (4) drawing? What lines of motor training ought the school to afford, (1) in general, (2) for the hand, (3) in the grace and poise of carriage or bearing, (4) in any other line? Make observation tests of these points in one or more

school rooms and report the results.

5. Describe what you think must be the type of mental life of Helen Keller. (Read "The World I Live In," by Helen Keller.)

6. Study groups of children for signs of deficiency in brain power from lack of nutrition. From fatigue. From worry. From lack of sleep.

CHAPTER V

HABIT

Habit is our "best friend or worst enemy." We are "walking bundles of habits." Habit is the "fly-wheel of society," keeping men patient and docile in the hard or disagreeable lot which some must fill. Habit is a "cable which we cannot break." So say the wise men. Let me know your habits of life and you have revealed your moral standards and conduct. Let me discover your intellectual habits, and I understand your type of mind and methods of thought. In short, our lives are largely a daily round of activities dictated by our habits in this line or that. Most of our movements and acts are habitual; we think as we have formed the habit of thinking; we decide as we are in the habit of deciding; we sleep, or eat, or speak as we have grown into the habit of doing these things; we may even say our prayers or perform other religious exercises as matters of habit. But while habit is the veriest tyrant, yet its good offices far exceed the bad even in the most fruitless or depraved life.

1. THE NATURE OF HABIT

Many people when they speak or think of habit give the term a very narrow or limited meaning. They have in mind only certain moral or personal tendencies usually spoken of as one's "habits." But in order to understand habit in any thorough and complete way we must, as suggested by the preceding paragraph, broaden our concept to include every possible line of physical and mental activity. Habit may be defined as *the tendency of the nervous system to repeat any act that has been performed once or many times*.

The Physical Basis of Habit.—Habit is to be explained from the standpoint of its physical basis. Habits are formed because the tissues of our brains are capable of being modified by use, and of so retaining the effects of this modification that the same act is easier of performance each succeeding time. This results in the old act being repeated instead of a new one being selected, and hence the old act is perpetuated.

Even dead and inert matter obeys the same principles in this regard as does living matter. Says M. Leon Dumont: "Everyone knows how a garment, having been worn a certain time, clings to the shape of the body better than when it was new; there has been a change in the tissue, and this change is a new habit of cohesion; a lock works better after having been used some time; at the outset more force was required to overcome certain

roughness in the mechanism. The overcoming of this resistance is a phenomenon of habituation. It costs less trouble to fold a paper when it has been folded already. This saving of trouble is due to the essential nature of habit, which brings it about that, to reproduce the effect, a less amount of the outward cause is required. The sounds of a violin improve by use in the hands of an able artist, because the fibers of the wood at last contract habits of vibration conformed to harmonic relations. This is what gives such inestimable value to instruments that have belonged to great masters. Water, in flowing, hollows out for itself a channel, which grows broader and deeper; and, after having ceased to flow, it resumes when it flows again the path traced for itself before. Just so, the impressions of outer objects fashion for themselves in the nervous system more and more appropriate paths, and these vital phenomena recur under similar excitements from without, when they have been interrupted for a certain time."[2]

All Living Tissue Plastic.—What is true of inanimate matter is doubly true of living tissue. The tissues of the human body can be molded into almost any form you choose if taken in time. A child may be placed on his feet at too early an age, and the bones of his legs form the habit of remaining bent. The Flathead Indian binds a board on the skull of his child, and its head forms the habit of remaining flat on the top. Wrong bodily postures produce curvature of the spine, and pernicious modes of dress deform the bones of the chest. The muscles may be trained into

[2] Quoted by James, "Psychology," Briefer Course, p. 135.

the habit of keeping the shoulders straight or letting them droop; those of the back, to keep the body well up on the hips, or to let it sag; those of locomotion, to give us a light, springy step, or to allow a shuffling carriage; those of speech, to give us a clear-cut, accurate articulation, or a careless, halting one; and those of the face, to give us a cheerful cast of countenance, or a glum and morose expression.

Habit a Modification of Brain Tissue.—But the nervous tissue is the most sensitive and easily molded of all bodily tissues. In fact, it is probable that the real *habit* of our characteristic walk, gesture, or speech resides in the brain, rather than in the muscles which it controls. So delicate is the organization of the brain structure and so unstable its molecules, that even the perfume of the flower, which assails the nose of a child, the song of a bird, which strikes his ear, or the fleeting dream, which lingers but for a second in his sleep, has so modified his brain that it will never again be as if these things had not been experienced. Every sensory current which runs in from the outside world; every motor current which runs out to command a muscle; every thought that we think, has so modified the nerve structure through which it acts, that a tendency remains for a like act to be repeated. Our brain and nervous system is daily being molded into fixed habits of acting by our thoughts and deeds, and thus becomes the automatic register of all we do.

The old Chinese fairy story hits upon a fundamental and vital truth. These celestials tell their children that each child is

accompanied by day and by night, every moment of his life, by an invisible fairy, who is provided with a pencil and tablet. It is the duty of this fairy to put down every deed of the child, both good and evil, in an indelible record which will one day rise as a witness against him. So it is in very truth with our brains. The wrong act may have been performed in secret, no living being may ever know that we performed it, and a merciful Providence may forgive it; but the inexorable monitor of our deeds was all the time beside us writing the record, and the history of that act is inscribed forever in the tissues of our brain. It may be repented of bitterly in sackcloth and ashes and be discontinued, but its effects can never be quite effaced; they will remain with us a handicap till our dying day, and in some critical moment in a great emergency we shall be in danger of defeat from that long past and forgotten act.

We Must Form Habits.—We *must*, then, form habits. It is not at all in our power to say whether we will form habits or not; for, once started, they go on forming themselves by day and night, steadily and relentlessly. Habit is, therefore, one of the great factors to be reckoned with in our lives, and the question becomes not, Shall we form habits? but *What habits we shall form.* And we have the determining of this question largely in our own power, for habits do not just happen, nor do they come to us ready made. We ourselves make them from day to day through the acts we perform, and in so far as we have control over our acts, in that far we can determine our habits.

2. THE PLACE OF HABIT IN THE ECONOMY OF OUR LIVES

Habit is one of nature's methods of economizing time and effort, while at the same time securing greater skill and efficiency. This is easily seen when it is remembered that habit tends towards *automatic* action; that is, towards action governed by the lower nerve centers and taking care of itself, so to speak, without the interference of consciousness. Everyone has observed how much easier in the performance and more skillful in its execution is the act, be it playing a piano, painting a picture, or driving a nail, when the movements involved have ceased to be consciously directed and become automatic.

Habit Increases Skill and Efficiency.—Practically all increase in skill, whether physical or mental, depends on our ability to form habits. Habit holds fast to the skill already attained while practice or intelligence makes ready for the next step in advance. Could we not form habits we should improve but little in our way of doing things, no matter how many times we did them over. We should now be obliged to go through the same bungling process of dressing ourselves as when we first learned it as children. Our writing would proceed as awkwardly in the high school as the primary, our eating as adults would be as messy and wide of the mark as when we were infants, and we should miss in a thousand ways the motor skill that now seems so easy

and natural. All highly skilled occupations, and those demanding great manual dexterity, likewise depend on our habit-forming power for the accurate and automatic movements required.

So with mental skill. A great portion of the fundamentals of our education must be made automatic—must become matters of habit. We set out to learn the symbols of speech. We hear words and see them on the printed page; associated with these words are meanings, or ideas. Habit binds the word and the idea together, so that to think of the one is to call up the other—and language is learned. We must learn numbers, so we practice the "combinations," and with 4×6, or 3×8 we associate 24. Habit secures this association in our minds, and lo! we soon know our "tables." And so on throughout the whole range of our learning. We learn certain symbols, or facts, or processes, and habit takes hold and renders these automatic so that we can use them freely, easily, and with skill, leaving our thought free for matters that cannot be made automatic. One of our greatest dangers is that we shall not make sufficiently automatic, enough of the necessary foundation material of education. Failing in this, we shall at best be but blunderers intellectually, handicapped because we failed to make proper use of habit in our development.

For, as we have seen in an earlier chapter, there is a limit to our mental energy and also to the number of objects to which we are able to attend. It is only when attention has been freed from the many things that can always be thought or done *in the same way*, that the mind can devote itself to the real problems that

require judgment, imagination or reasoning. The writer whose spelling and punctuation do not take care of themselves will hardly make a success of writing. The mathematician whose number combinations, processes and formulæ are not automatic in his mind can never hope to make progress in mathematical thinking. The speaker who, while speaking, has to think of his gestures, his voice or his enunciation will never sway audiences by his logic or his eloquence.

Habit Saves Effort and Fatigue.—We do most easily and with least fatigue that which we are accustomed to do. It is the new act or the strange task that tires us. The horse that is used to the farm wearies if put on the road, while the roadster tires easily when hitched to the plow. The experienced penman works all day at his desk without undue fatigue, while the man more accustomed to the pick and the shovel than to the pen, is exhausted by a half hour's writing at a letter. Those who follow a sedentary and inactive occupation do not tire by much sitting, while children or others used to freedom and action may find it a wearisome task merely to remain still for an hour or two.

Not only would the skill and speed demanded by modern industry be impossible without the aid of habit, but without its help none could stand the fatigue and strain. The new workman placed at a high-speed machine is ready to fall from weariness at the end of his first day. But little by little he learns to omit the unnecessary movements, the necessary movements become easier and more automatic through habit, and he finds the work

easier. We may conclude, then, that not only do consciously directed movements show less skill than the same movements made automatic by habit, but they also require more effort and produce greater fatigue.

Habit Economizes Moral Effort.—To have to decide each time the question comes up whether we will attend to this lecture or sermon or lesson; whether we will persevere and go through this piece of disagreeable work which we have begun; whether we will go to the trouble of being courteous and kind to this or that poor or unlovely or dirty fellow-mortal; whether we will take this road because it looks easy, or that one because we know it to be the one we ought to take; whether we will be strictly fair and honest when we might just as well be the opposite; whether we will resist the temptation which dares us; whether we will do this duty, hard though it is, which confronts us—to have to decide each of these questions every time it presents itself is to put too large a proportion of our thought and energy on things which should take care of themselves. For all these things should early become so nearly habitual that they can be settled with the very minimum of expenditure of energy when they arise.

The Habit of Attention.—It is a noble thing to be able to attend by sheer force of will when the interest lags, or some more attractive thing appears, but far better is it so to have formed the habit of attention that we naturally fall into that attitude when this is the desirable thing. To understand what I mean, you only have to look over a class or an audience and note the different

ways which people have of finally settling down to listening. Some with an attitude which says, "Now here I am, ready to listen to you if you will interest me, otherwise not." Others with a manner which says, "I did not really come here expecting to listen, and you will have a large task if you interest me; I never listen unless I am compelled to, and the responsibility rests on you." Others plainly say, "I really mean to listen, but I have hard work to control my thoughts, and if I wander I shall not blame you altogether; it is just my way." And still others say, "When I am expected to listen, I always listen whether there is anything much to listen to or not. I have formed that habit, and so have no quarrel with myself about it. You can depend on me to be attentive, for I cannot afford to weaken my habit of attention whether you do well or not." Every speaker will clasp these last listeners to his heart and feed them on the choicest thoughts of his soul; they are the ones to whom he speaks and to whom his address will appeal.

Habit Enables Us to Meet the Disagreeable.—To be able to persevere in the face of difficulties and hardships and carry through the disagreeable thing in spite of the protests of our natures against the sacrifice which it requires, is a creditable thing; but it is more creditable to have so formed the habit of perseverance that the disagreeable duty shall be done without a struggle, or protest, or question. Horace Mann testifies of himself that whatever success he was able to attain was made possible through the early habit which he formed of never stopping to

inquire whether he *liked* to do a thing which needed doing, but of doing everything equally well and without question, both the pleasant and the unpleasant.

The youth who can fight out a moral battle and win against the allurements of some attractive temptation is worthy the highest honor and praise; but so long as he has to fight the same battle over and over again, he is on dangerous ground morally. For good morals must finally become habits, so ingrained in us that the right decision comes largely without effort and without struggle. Otherwise the strain is too great, and defeat will occasionally come; and defeat means weakness and at last disaster, after the spirit has tired of the constant conflict. And so on in a hundred lines. Good habits are more to be coveted than individual victories in special cases, much as these are to be desired. For good habits mean victories all along the line.

Habit the Foundation of Personality.—The biologist tells us that it is the *constant* and not the *occasional* in the environment that impresses itself on an organism. So also it is the *habitual* in our lives that builds itself into our character and personality. In a very real sense we *are* what we are in the habit of doing and thinking.

Without habit, personality could not exist; for we could never do a thing twice alike, and hence would be a new person each succeeding moment. The acts which give us our own peculiar individuality are our habitual acts—the little things that do themselves moment by moment without care or attention, and

are the truest and best expression of our real selves. Probably no one of us could be very sure which arm he puts into the sleeve, or which foot he puts into the shoe, first; and yet each of us certainly formed the habit long ago of doing these things in a certain way. We might not be able to describe just how we hold knife and fork and spoon, and yet each has his own characteristic and habitual way of handling them. We sit down and get up in some characteristic way, and the very poise of our heads and attitudes of our bodies are the result of habit. We get sleepy and wake up, become hungry and thirsty at certain hours, through force of habit. We form the habit of liking a certain chair, or nook, or corner, or path, or desk, and then seek this to the exclusion of all others. We habitually use a particular pitch of voice and type of enunciation in speaking, and this becomes one of our characteristic marks; or we form the habit of using barbarisms or solecisms of language in youth, and these cling to us and become an inseparable part of us later in life.

On the mental side the case is no different. Our thinking is as characteristic as our physical acts. We may form the habit of thinking things out logically, or of jumping to conclusions; of thinking critically and independently, or of taking things unquestioningly on the authority of others. We may form the habit of carefully reading good, sensible books, or of skimming sentimental and trashy ones; of choosing elevating, ennobling companions, or the opposite; of being a good conversationalist and doing our part in a social group, or of being a drag on the

conversation, and needing to be "entertained." We may form the habit of observing the things about us and enjoying the beautiful in our environment, or of failing to observe or to enjoy. We may form the habit of obeying the voice of conscience or of weakly yielding to temptation without a struggle; of taking a reverent attitude of prayer in our devotions, or of merely saying our prayers.

Habit Saves Worry and Rebellion.—Habit has been called the "balance wheel" of society. This is because men readily become habituated to the hard, the disagreeable, or the inevitable, and cease to battle against it. A lot that at first seems unendurable after a time causes less revolt. A sorrow that seems too poignant to be borne in the course of time loses some of its sharpness. Oppression or injustice that arouses the fiercest resentment and hate may finally come to be accepted with resignation. Habit helps us learn that "what cannot be cured must be endured."

3. THE TYRANNY OF HABIT

Even Good Habits Need to Be Modified.—But even in good habits there is danger. Habit is the opposite of attention. Habit relieves attention of unnecessary strain. Every habitual act was at one time, either in the history of the race or of the individual, a voluntary act; that is, it was performed under active attention. As the habit grew, attention was gradually rendered unnecessary, until finally it dropped entirely out. And herein lies the danger. Habit once formed has no way of being modified unless in some way attention is called to it, for a habit left to itself becomes more and more firmly fixed. The rut grows deeper. In very few, if any, of our actions can we afford to have this the case. Our habits need to be progressive, they need to grow, to be modified, to be improved. Otherwise they will become an incrusting shell, fixed and unyielding, which will limit our growth.

It is necessary, then, to keep our habitual acts under some surveillance of attention, to pass them in review for inspection every now and then, that we may discover possible modifications which will make them more serviceable. We need to be inventive, constantly to find out better ways of doing things. Habit takes care of our standing, walking, sitting; but how many of us could not improve his poise and carriage if he would? Our speech has become largely automatic, but no doubt all of us might remove

faults of enunciation, pronunciation or stress from our speaking. So also we might better our habits of study and thinking, our methods of memorizing, or our manner of attending.

Конец ознакомительного фрагмента.