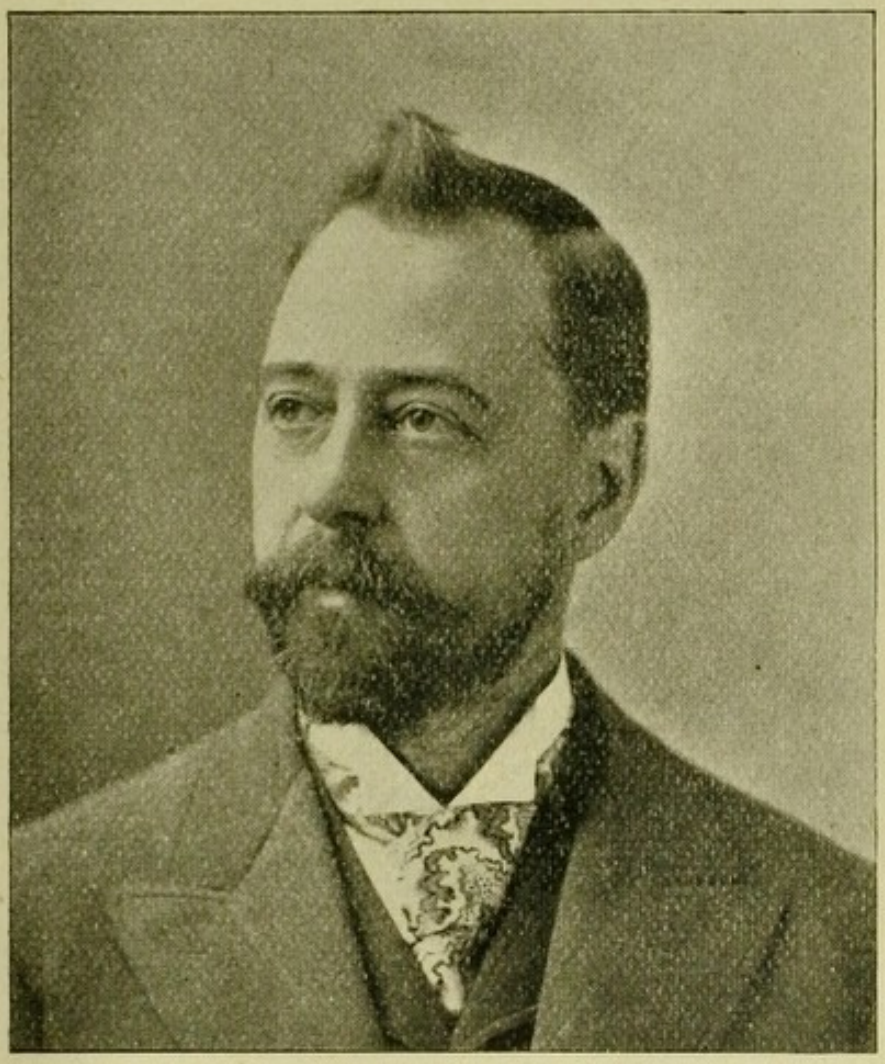
The mind and its machinery. Vol. I, The scientific basis for reading character : a new and simplified description of the temperaments, explaining how to estimate the powers, talents, tendencies and capabilities of man and all other animals, a description of body and mind, their mutual inter-relations, and the influence of each upon the other, together with a new and original philosophy regarding the operation of a part of the bodily organs / by V. P. English.

The Mind And Its Machinery



V. P. ENGLISH, M.D.

THE MIND

AND ITS MACHINERY

BY

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VOL. I.

THE SCIENTIFIC BASIS FOR

READING CHARACTER

A NEW AND SIMPLIFIED DESCRIPTION OF THE

TEMPERAMENTS

EXPLAINING HOW TO ESTIMATE THE POWERS, TALENTS, TENDENCIES AND CAPABILITIES OF MAN AND ALL OTHER ANIMALS. A DESCRIPTION OF

BODY AND MIND

THEIR MUTUAL INTER-RELATIONS, AND THE INFLUENCE OF EACH UPON THE OTHER, TOGETHER WITH A NEW AND ORIGINAL PHILOSOPHY REGARDING THE OPERATION OF A PART OF THE BODILY ORGANS.

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INTRODUCTION.

ALL the explanations that we desire to offer in regard to this volume, are to be found in the text. It is therefore submitted, without apology or comment, to the personal judgment of each individual reader.

V. P. E.

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THE MIND AND ITS MACHINERY.

CHAPTER I.

MIND AND BODY.

The mind is the man. The body, its workshop—the tools, implements or machinery by which it acts upon the material things of this world and accomplishes its purposes.

Whether the mind is spirit, or force, or matter; and whether or not the mind and spirit are one and the same thing; and to what extent the mind may act independent of the body in this world, we will not attempt to discuss. For our present purpose it is sufficient to know that the mind is

THE GREAT CONTROLLING AND DIRECTING POWER,

and that the body is the machinery by which it accomplishes its desires. The mind is the pilot: the body, the ship that it guides across the sea of life. The mind is a great manufacturer: the body, the factory or workshop required to enable it to turn out a finished product. The mind is the musician: the body, its harp of a thousand strings.

APPROPRIATE MACHINERY REQUIRED.

The mind alone cannot preach a sermon, deliver a lecture nor sing a song that will reach the understanding of mortals. To accomplish these things, it requires the aid of its appropriate machinery—the body.

MUTUAL DEPENDENCE OF MIND AND BODY.

And the body alone is equally helpless. When it is not quickened, guided and directed by the mind, it is but lifeless clay. Each thus requires the aid of the other and is completely helpless when that aid is withheld. But the two combined may accomplish wonders. And the one is just as necessary as the other. The mind requires the aid of appropriate machinery in order to accomplish its desires, and the body constitutes that machinery.

DIFFERENT TOOLS REQUIRED FOR DIFFERENT KINDS OF WORK.

To paint a picture, chisel a statue or erect a building, the mind and body combined, require the aid of still other tools; and these tools bear about the same relation to the combined mind and body, that the body alone bears to the mind. They are the means employed in the accomplishment of certain desires.

The tools required to do one thing, are very different from those used in accomplishing another. To erect a dwelling, for example, it requires an entirely

different class of tools from those used by an artist in painting a picture. And nobody who knows anything about either, will ever mistake a carpenter shop for an artist's studio. In

ESTIMATING PHYSICAL AND MENTAL CAPABILITIES,

the same principles apply, and nobody who has even a small degree of knowledge and common sense regarding the indications of character, will ever mistake the machinery sufficient for the mind of an idiot, for that required to accomplish the desires of a philosopher's mind.

KIND OF WORK DONE, INDICATED BY KIND OF TOOLS USED.

A man who is perfectly familiar with mechanical pursuits, can tell you what kind of mechanics work in the various shops and factories that he passes as he walks through the streets, because he knows what can be best accomplished by the tools and machinery that he sees in the doors and windows, and that each artisan uses the kind that is best adapted to assist him in accomplishing his desires. If he sees a shop containing chisels and planes, and a brace and bits, and other tools adapted only to working wood, he will know to a positive certainty that it is not the shop of a blacksmith. On the other hand, if the tools he sees in another shop, are an anvil, a forge, hammers and tongs, he will know that it

is not the workshop of a cabinetmaker, carpenter nor shoemaker, but that it is a blacksmith shop; and that these tools are adapted only to the work of a blacksmith, and consequently that it is a blacksmith who works there.

THE SCIENCE OF READING CHARACTER

is based upon the same principles, and the student of human nature reaches his conclusions in about the same way. His observations and the manner of his reasoning are practically the same. When he carefully examines the machinery used by a human mind, and correctly estimates what can be best accomplished by the aid of that machinery, he can then correctly describe the mind that uses it. Or perhaps it will more clearly express our meaning, to say that he can correctly describe this combination of mind and body, and successfully estimate their combined capacities and capabilities. For the mind is something that we really know but little about except as we see its manifestation through its appropriate machinery—the body.

CAPABILITIES OF MIND, LIKE A MUSICIAN'S PERFORMANCE, LIMITED BY CAPACITY OF INSTRUMENT USED.

But this is all that is required to enable us to correctly estimate character, because the capabilities of the mind are limited by the capabilities of the body. Just as the performance of an instrumental musician is

limited by the capacity of his instrument. It matters not how proficient the musician may be, the superiority of his performance cannot exceed the capacity of the instrument he uses. It is impossible for him to produce perfect music of all varieties upon an instrument that is out of tune or deficient or defective in any way whatever. But a part of the strings of an instrument may be broken or out of tune when all the rest are in good condition. And while this greatly reduces the capacity of the instrument, it may still be sufficient for a large number of selections and a decided variety that do not require the deficient parts. And a correct estimate of the capacity of the instrument, determines the possibilities of the musician using it. In other words, it is not necessary to examine the musician in order to determine the limit of his music upon that instrument. The conditions to be met in estimating character are practically the same. It is not necessary to examine the mind in order to determine its capabilities. It is sufficient to correctly estimate the possibilities of its instrument—the body.

A COMPLETE AND PERFECT MIND

is very rare. The great majority of men are found to resemble the defective instrument—they are out of tune, inharmonious and deficient in various ways. And while they are a grand success in a certain sphere, they

are complete failures in others. While they may gain distinction and reach the top round of the ladder in one vocation, they must always remain at the bottom if they engage in another. They are not "all round" men, complete in all the essentials of a perfect character, but lack certain important parts. Hence they are not qualified to compete with their fellowmen in all things, but must fall behind in a competition in which success is given by qualities that they possess in but a small degree. They are

OUT OF TUNE WITH OUR SOCIAL CONDITIONS,

and it is impossible for them to exhibit harmony in all the affairs of life. Yet, in the music of many of our social matters, they are a success. While they are perhaps insufficient for "The Thunder Storm" and selections from Mozart or Ole Bull, yet they may be a success in "Old Hundred" or "Yankee Doodle." And the latter are often in better demand, and are more appropriate and consequently command a better price than the former. Many a lawyer who can readily practice to the tune of "Ten Thousand a Year," would find "I've Seen Better Days," much more appropriate if he should attempt to design and erect buildings. The opera singer who warbles to the tune of many thousands a year and enjoys her life and the good things of this world that her talents bring, would frequently be

a very indifferent housekeeper. And one of the important duties of the professional student of human nature, is to examine these various

HUMAN INSTRUMENTS OF MUSIC,

of harmony or discord, and to ascertain their range and determine what selections are not beyond the limits of their capacities.

The study of character then, is a study of the machinery used by the mind—an analysis of this machinery and a study of its different parts. And after the value of each important part is ascertained, the study is then by synthesis, and it consists in determining the capacity and capabilities of the combination produced by the union of all these component parts into a complete whole—a study of the various elements of character and an estimate of the man or woman produced by their combination.

CAUSE OF MISTAKES IN READING CHARACTER.

The latter is the most difficult part in reading character. Many students utterly fail in this when they are quite successful in estimating the various individual elements. This is one of the most important reasons why so many otherwise intelligent and well-informed men and women think that there is no such thing as a science of reading character. They observe and properly measure some of the elements of a char-

acter, but fail in correctly estimating the value of the combination produced by their union with all the other elements. They draw erroneous conclusions regarding the complete character. Those who claim to be professional frequently make the same mistake. Honest students are thus often led to conclude that the whole matter is not a science, and that its claims are not true. But the fault is in their erroneous conclusions and not in the science.

How we analyze and study the various parts of this wonderful and complicated machinery used by the human mind, and how we estimate the value of the various elements and ascertain the kind of character produced by their combination, will all be explained in future chapters.

CHAPTER II.

FOUNDATION PRINCIPLES AND WHAT THEY EXPLAIN.

The fundamental principles to which we have briefly referred in the preceding chapter, not only support the science of reading character, or the estimation of every animal's physical and mental powers, talents and capabilities, but they are also the foundation of other branches of science, a part of which are but imperfectly understood at the present time.

HYPNOTISM, CHRISTIAN SCIENCE, ETC.

Prominent among the latter, are hypnotism, telepathy, mind cure, faith cure and Christian science.

EDUCATION, PHYSICAL CULTURE, HEALTH, ETC.

These principles also throw a great deal of light upon education, physical culture, health, disease, hygiene and other scientific studies that we will not enumerate in this connection, but hope to discuss in another volume, together with the branches that we have mentioned, besides others that rest upon these principles, together with other principles that will be discussed in this volume.

The importance of these principles, will therefore justify us in examining them pretty thoroughly; especially those that differ from the commonly accepted ideas. Among those that will receive our early attention, are the principles involved in the construction and operation of the machinery that we call the physical body, and which the mind uses to act upon matter and thus accomplish its desires in this material world.

CORRESPONDENCE OF BODY AND MIND.

But we will first briefly state a part of the reasons why the body and mind correspond with each other, and why the body indicates the qualities of the mind that uses it.

The foremost reason, and the one most important of all, is because

THE MIND BUILDS THE BODY;

and it builds the kind of a body that will best execute its desires. Every animal comes into existence with certain inherited tendencies. Tendencies that are transmitted by its parents. These tendencies are given to the mind. And the mind proceeds to develop a body that will execute the desires that result from these inherited tendencies. If it inherits a tendency to eat flesh, it develops the physical machinery that will accomplish that act. If it inherits a tendency to subsist

upon vegetation, the physical machinery necessary to this end, is developed. If it inherits a tendency to fly, swim, or to move upon the earth, it develops the machinery necessary to execute these inherited tendencies.

If the animal is a human being, and it inherits a strong desire to exhibit physical force, a combination of physical machinery favorable to this end, is developed. And the efficacy of the machinery measures the strength and directness of the mental desires that built it.

If a person inherits a desire to reason or to investigate the causes of things or the secrets of nature, a brain and physical machinery necessary to execute these desires, will be developed. And their effectiveness will measure the strength, directness and singleness of purpose, in the mental desires that were instrumental in their construction.

EXPLANATION OF CHRISTIAN SCIENCE CURES.

These facts assist us to explain the cures effected through Christian science, mind cure, faith cure, and all those means that seem so inadequate to the results reported. That cures, and many of them of the most astonishing kind, have been effected by almost every means employed, that has been pushed to any great extent, and with meritorious industry and earnestness, is simply a matter of history. To deny that legitimate cures, and in very respectable numbers, are effected by

what is called Christian science, mental science, suggestion, faith, etc., is but to exhibit ignorance, prejudice or dishonesty regarding facts open to all. But to conclude that these cures are effected in the way that the advocates of these so-called sciences claim that they are, is quite another proposition.

It is our opinion that such cures are effected through the operation of the laws that are examined in this book. And very largely through the operation of the law just mentioned—that the mind builds the body and that it builds the kind of a body that will best execute its desires.

DISEASE AND DEATH CAUSED BY A WRONG ACTION OF THE MIND.

We believe that many of the diseases that afflict the human body, are the direct result of a wrong action of the mind; or a right action too long continued. Or rather, perhaps, that is continued to the exclusion of other actions that are necessary to continued health.

We therefore conclude that there are many diseases that can be cured by the mind. There are other diseases arising from different causes that cannot be cured in this way. Many of those that can be cured by the action of the mind, cannot be cured in any other way.

CLASSIFICATION OF DISEASES CURABLE AND THOSE INCURABLE BY THE MIND.

We also believe that it is possible to classify these different diseases and to designate those that will respond to mental treatment, and those that require some other means.

The evidence supporting these conclusions will accumulate as we proceed. And for the present we will pass this subject with the promise to discuss it more fully in future pages. The principles that we shall discuss in our examination of character reading, will assist us in understanding the relations of the mind to health and disease, and to many other important affairs of life. And, as we think that it will facilitate our studies to first consider these principles in their relations to character and to character reading, we have adopted that order, and will apply them later to the elucidation of other branches of science.

We will now proceed to an examination of the construction and operation of the human body, and to the methods by which the mind operates its machinery.

CHAPTER III.

THE MACHINE—TEMPERAMENT.

AN EXPLANATION.

The object of this book is not to go into an exhaustive study of anatomy and physiology, and the chemistry and microscopic composition of the body; but we shall aim to discuss such of their general principles as will assist the reader in understanding how to estimate character, or physical and mental capabilities and tendencies, and how best to maintain and increase the body's health and vigor, and how to best train and discipline the mind; and especially to investigate the wonderfully complicated combinations of mechanical principles found in the human body, and to show how the physical organs act as servants to the mind, and indicate the character of the mind that uses them. We shall therefore treat the body as a machine, and will aim to discuss only such principles of anatomy, physiology, chemistry and histology, as seem necessary to a clear understanding of the human body as a machine used by the mind in accomplishing the purposes of its existence upon this earth.* We will first take .

*NOTE.—Readers unfamiliar with physiology, chemistry, etc. who desire more information on these subjects than we shall give, are referred to the numerous common school and medical text books. A list of excellent books on these subjects follows the appendix at the close of this volume.

A GENERAL SURVEY OF THE MACHINE,

and will then proceed to analyze it and classify its more important parts.

A little thought and investigation show us that the mechanical and chemical principles exhibited in our workshops and factories and chemical laboratories, are the same exactly as those found in the human body. Even the method of generating the power necessary to operate machinery in factories and workshops, bears a very close resemblance to the manner of generating vital force in the human machine.

We do our physical work, and think, and love, and hate, by the aid of appropriate machinery that works upon the same principles as the machinery combined into a locomotive that thunders across the country drawing its heavy train of cars. And the vital force that renders physical and mental work possible, is generated in a manner that is practically the same as that employed in generating the force that operates a steam engine. All of our work, whether physical or mental, is accomplished by the mind acting upon appropriate machinery in the body; and what the mind can accomplish is limited by the capabilities of the physical machinery that it uses, just as surely as the work of an engineer is limited by the capabilities of the engine that he controls.

ELECTRICAL FORCES AND MACHINERY IN THE BODY.

The wonderful discoveries and inventions in electricity that have been made during the last few years, have their counterparts in the human body. The body has its batteries or dynamos for generating nerve force, which is practically the same thing to the body that electricity is to electrical machinery. The body has its telegraph or telephone system, and late discoveries seem to indicate that it also has a phonograph system. It has within itself, when acted upon by the mind, the power of locomotion and of acting upon external objects. It may ascend to the mountain tops or descend into the bowels of the earth. It may live in the tropics or the frigid zones, and travel from one to the other, and maintain within itself almost the same degree of temperature in the one locality as in the other. It possesses the ability to nourish itself and to maintain its powers and repair injuries that it may sustain. It can secure and appropriate the material necessary to maintain its powers and cast out of itself exhausted and useless materials. Or, rather, the mind can accomplish all of those things by using the body as a machine. And when we closely study this machine, we find that it does its work upon practically the same principles as the work done in our manufacturing establishments and laboratories. And he who can cor-

rectly estimate the efficacy of the various parts of the human machine, and the effect of their combination, can also read character.

THE MACHINE ANALYZED.

And without any futher preliminary remarks, we will now proceed to analyze and classify the various parts of the human machine, and to study the effect that each part has upon character.

THE THREE TEMPERAMENTS.

Most of the organs of the human body may be divided into three distinct classes. And for the want of a better name, and because it is the word usually employed to express the meaning that we desire to convey, we shall call each of these classes of organs, a temperament.

MOTIVE TEMPERAMENT.

One of these classes of organs or parts of the body, comprises the organs of locomotion, and those that give the body form and stability; and in some parts, protection to the more delicate organs. It also includes the organs employed in moving the different parts of the body upon each other, as the arms, fingers, jaws, etc. As this class includes the parts of the body immediately concerned in locomotion, it is called the *Motive Temper-*

ament. It includes all the bones, ligaments, cartileges, voluntary muscles and tendons in the body. And when these parts of the human machine are large and strong in comparison with the other parts of the body, a distinctive physical appearance is given, and the person is said to have the motive temperament; or to be a person of the motive temperment. And all such persons have distinctive mental characteristics that differ from those of persons with any other temperament.

The next class of organs or parts of the machine that we shall consider, are those concerned in the vital economies of the body. This class is called the

VITAL TEMPERAMENT.

It includes most of the organs within the trunk. The lungs, heart, stomach, liver, kidneys, bowels, etc.—all the organs concerned in nourishing the body and in removing waste and useless materials therefrom. The skin really belongs to this class, but it is not usually considered in estimating the temperaments. Its state has an influence upon capabilities, however, and it should not be ignored. Persons in whom the vital organs are large and active in proportion to other parts of the body, are said to be persons of the vital temperament; or, that they have the vital temperament. Their physical appearance and mental characteristics

are decidedly different from those of the other temperaments.

MENTAL TEMPERAMENT.

The brain and nervous system constitute the third class. As this class of organs is more intimately related to the mind than is any other part of the body, it is called the mental temperament.

The mind acts directly upon these organs, and through them it controls other parts of the body. When the brain is large and active, and the nervous system is active and influential in comparison with the other parts of the body, a distinctive physical appearance is given that is in marked contrast to either of the other temperaments. And the mental characteristics of a person of the mental temperament contrasts in an equally marked degree with those of either of the other temperaments.

BALANCED TEMPERAMENT.

A person in whom all three of the temperaments are about equal, is said to be balanced; or to be a person of the balanced temperament; or to have a balanced temperament.

Such a person does not exhibit the distinguishing characteristics peculiar to either of the three temperaments before mentioned, but is more evenly developed and harmonious in build, and the mental powers are

characterized by an evenness, harmony, breadth and versatility never found in either the motive, vital or mental temperament. These persons possess in a fair degree the qualities peculiar to each of the other three temperaments, but none of the extremes.

Their evenness and harmony of build, give them a physical appearance that is quite different from that given by either of the other temperaments.

The hair and nails indicate character, and usually exhibit qualities peculiar to the temperament with which they are associated; and they often aid very much in deciding whether a person under consideration is of the motive, mental or vital temperament. This will be more fully explained later.

A FURTHER EXPLANATION.

The classification that we have just described, is known as the

PHRENOLOGICAL CLASSIFICATION OF THE TEMPERAMENTS.

- MOTIVE,
- VITAL,
- MENTAL,
- BALANCED.

This classification originated with the early American phrenologists, and was adopted by them during the first half of the nineteenth century. It is much more practical and useful in reading character than the

MEDICAL CLASSIFICATION.

The latter relates largely to conditions of health and disease, and is of very little assistance in reading character if it is used alone; but when employed to explain certain modifications in the Phrenological classification, it then becomes very useful, indeed, and will be fully explained later in this work.

The following is the medical classification most frequently used. But different names are sometimes employed by different authors to express meanings practically the same as those intended in this classification.

MEDICAL CLASSIFICATION OF TEMPERAMENTS.	BILIOUS,
	SANGUINE,
	LYMPHATIC,
	NERVOUS.

The bilious and sanguine temperaments are conditions of health; the other two, of disease. Each temperament is more fully explained in subsequent chapters.*

*See Appendix A.

CHAPTER IV.

MOTIVE TEMPERAMENT.

The organs constituting this temperament, are to the body, what the foundation, timbers, weatherboards, doors and hinges are to a house. Or the hull, masts, spars, ropes and pulleys to a sailing vessel. The following diagram exhibits the list of organs that form this temperment:

ORGANS COMPOSING THE MOTIVE TEMPERAMENT.	BONES, LIGAMENTS, CARTILEGES, VOLUNTARY MUSCLES, TENDONS.

THE BONES

are the foundation or framework of the human machine, and the levers and fulcrums upon which the muscles act in effecting all of the various movements of the body and of each particular part. It is the bones that give the body its form, stability and proportions. They also furnish points of attachment for many of the softer tissues and assist in keeping various

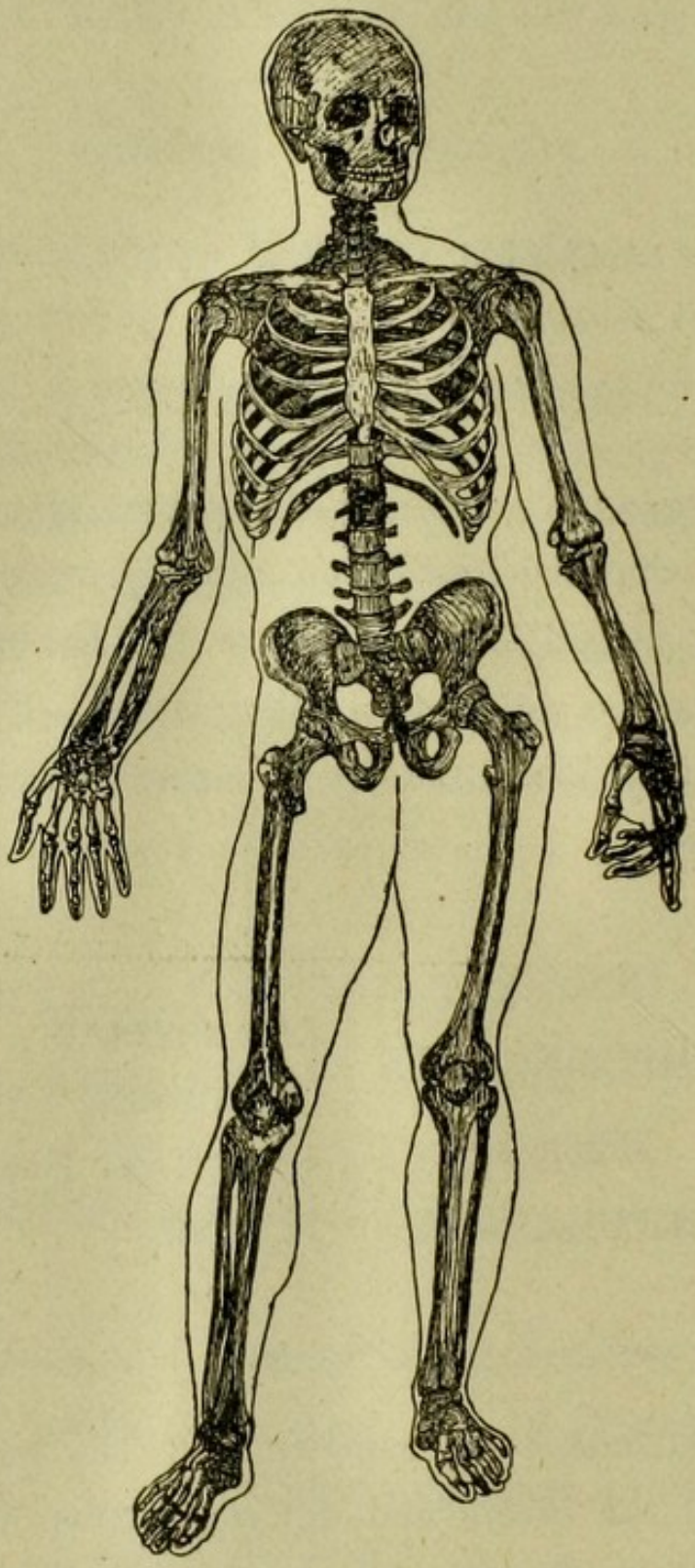

FIG. 1.

THE SKELETON.

The frame-work of bones that gives the body its size, stability and proportions, furnishing protection to many of the delicate organs within, and constituting the levers and fulcrums upon which the muscles act in effecting all of the varied movements of the body.

organs in their normal positions and proper relations to each other.

THE LONG BONES,

such as those in the arms and lower limbs, serve to give length and stability to these parts, and to act as levers and fulcrums for the muscles to act upon in walking, running and all the various movements in which these limbs participate.

THE FLAT BONES

also assist to give shape and stability to the body, and in many parts they are provided with prominences or projections that act as levers and fulcrums for the muscles to act upon. Both classes furnish points of attachment for the muscles. And the flat bones, such as the ribs and skull bones, and the bones in the hips and spine, form a protection to the delicate organs within.

LIGAMENTS.

The bones are kept in place at the joints by ligaments. The ligaments are very firm, strong, fibrous and elastic, and are of a whitish color. Some are cord-like in their structure, and others are broad, flat tissues. It is usually a rupture or tearing of these ligaments that takes place in what is called a sprain. In a sprain of the ankle or wrist, for example, some of the ligaments

are either broken or torn loose from their points of attachment to the bones.

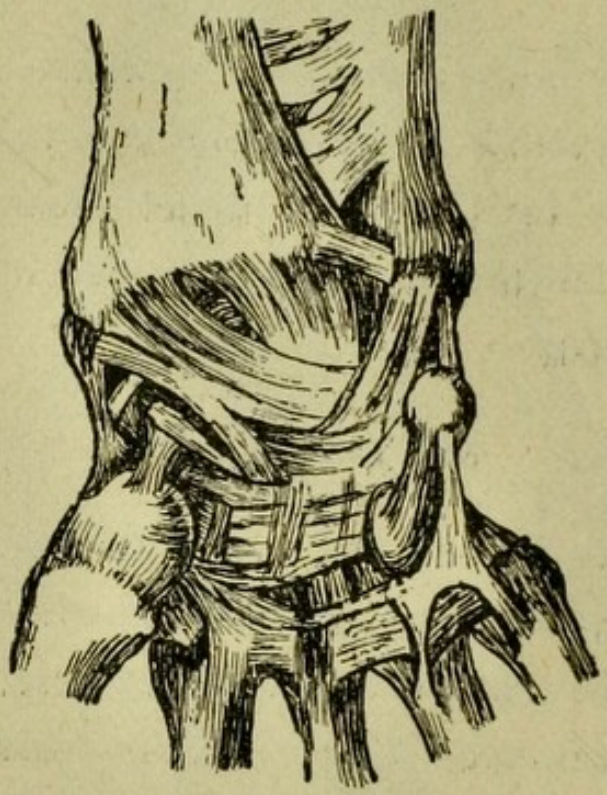

FIG. 2.

Palmar side of the bones and ligaments of the right wrist, showing how the ligaments bind the wrist bones to each other, and to the bones of the forearm and hand.

CARTILEGES

are elastic and compressible, much like India rubber. Their color is white. During early life they fill many places that are afterwards occupied by bones. Their functions are then practically the same as those of the bones that afterwards displace them. The cartilege in the breast of a young chicken is a good example of this. But in some parts of the human body, the car-

tileges remain permanently. Those in the breast to which the ribs are attached, remain during the entire life. Here they perform about the same functions as bones, but being more elastic, they serve a better purpose than bones, as elasticity and strength, but not immovability, are desirable. The cartileges also form cushions or springs at the joints, and decrease jars to the machine caused by its various movements. This is especially true of the cartileges in the spine between the vertebræ. Cartileges in the moving joints, such as the knees and elbows, and sockets of the hips and shoulders, serve to decrease friction by presenting a very smooth surface in the parts that move upon each other.

MUSCLES.

These are the organs that are immediately instrumental in effecting all the various movements of the human machine. They are fibrous in structure and of a reddish color. (The lean parts in beef, mutton, pork, etc., are the muscles.) Muscles possess the power of contracting and relaxing. And when they contract or shorten, their ends approach each other and carry with them the bones to which they are attached. For example, one end of a certain muscle is attached to the bone of the shoulder and to the bone of the arm near the shoulder. The other end of this muscle is attached to the front part of a bone in the forearm just be-

FIG. 3.

MUSCULAR SYSTEM.

The machinery that effects the innumerable movements of the body, by acting upon the levers and fulcrums formed by the various bones constituting the skeleton. Skin and other superficial tissues, are removed.

low the elbow joint. When this muscle contracts or shortens, it draws the forearm and hand towards the shoulder, and bends the elbow, just as a piece of India rubber similarly attached would do in contracting after it had been stretched. (See Fig. 4.) On the opposite side of the arm, there is a muscle that is antagonistic to the one just mentioned, and when the arm is to be moved in the opposite direction, the muscle first mentioned, relaxes, and the one on the opposite side of

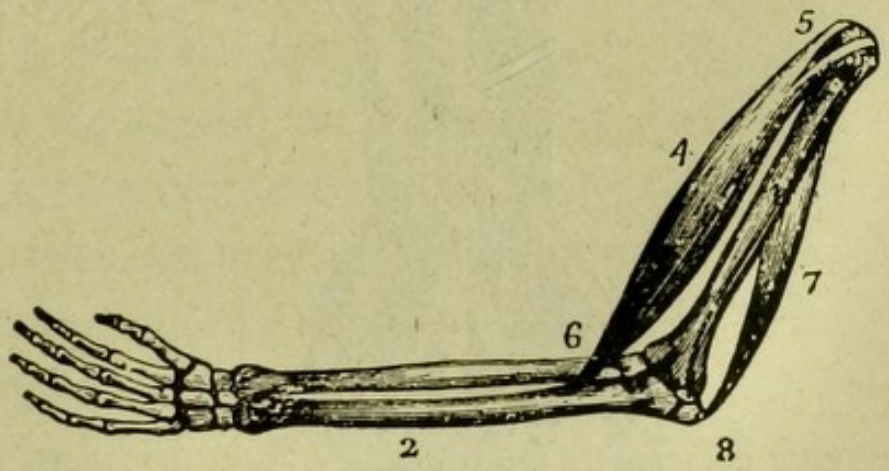

FIG. 4.

Bones of the arm, together with the muscle that bends the elbow and the one that straightens it; 5, 4, 6, biceps muscle; 7, triceps muscle.

the arm, contracts, and the limb moves in a direction opposite to the movement caused by the contraction of the muscle first mentioned. The muscles in all parts of the body act upon the same principle. And all movements of the body, no matter how complicated, are effected by the contraction and relaxation of muscles.

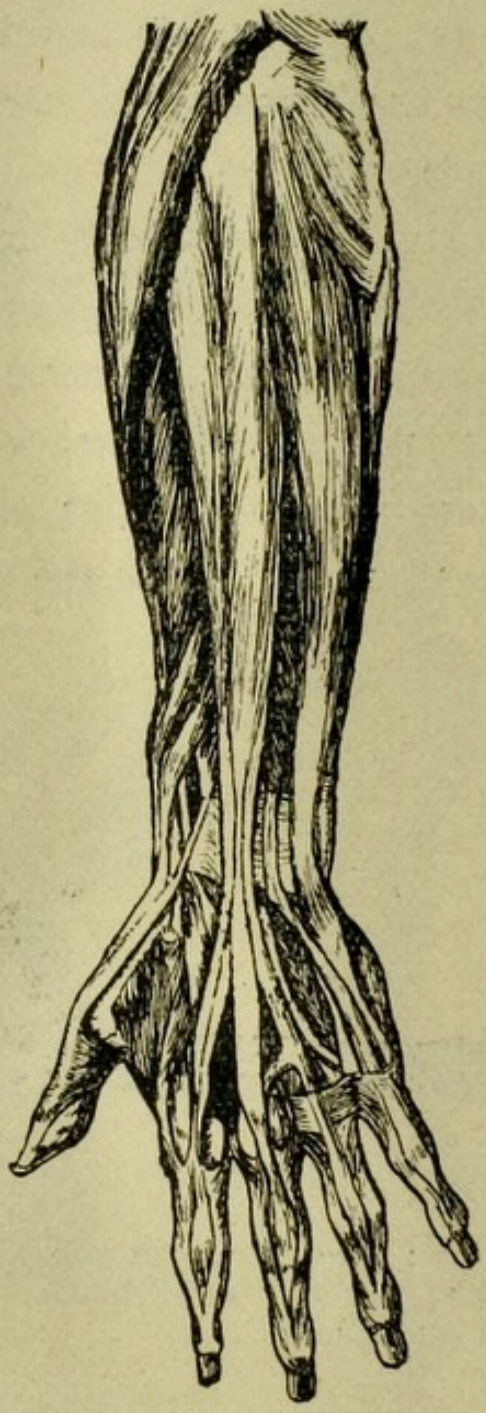

FIG. 5.

Muscles and tendons of the back of the left forearm and hand, showing how the tendons and muscles are connected to each other, and how the tendons are attached to the various bones of the fingers. It may be observed that the muscular fibers are attached to the sides of the tendons, and that some of the tendons are split and others pass through them to their points of attachment on the bones of the fingers, thus furnishing the requisite strength and effectiveness without great size.

THE TENDONS

resemble the ligaments in structure and color, but are usually longer, and connect muscles to bones, while the ligaments connect two or more bones to each other. The tendons are very dense and strong, resembling long white cords, and they are not elastic. The tendons do not contract like the muscles, but serve to connect muscles to parts to be moved by muscular contractions. They are found in such parts as the wrist, where great strength is required, but where any unnecessary size would be a decided disadvantage. The muscles that move the fingers, are in the fleshy part of the forearm, and each is connected with a tendon that passes through the wrist and hand to the bones in the fingers. When the fingers are to be moved, the muscles in the forearm contract and thus pull upon the tendons to which they are attached, and the tendons move the fingers. The manner in which the tendons act, together with their appearance, may be illustrated very nicely by examining and manipulating those in the leg and toes of a chicken.

ELEMENTS OF MOST IMPORTANCE.

Of the five constituent elements of the motive temperament, the bones and muscles are chief in importance as indications of character. And for two reasons, they are the only two elements that are usually considered in estimating the temperament. One reason, is

because it is very difficult to estimate the other three. And the other reason, is because they are supposed to partake of the same qualities as the bones and muscles, and that a correct estimate of the two, is a sufficiently accurate estimate of all. And for all practical purposes in estimating character, this is true. But we have deemed it best to describe them all, because it is our purpose in this book to explain the body as a machine; and to describe all parts of the mind's machinery with sufficient thoroughness to give the reader a picture or series of diagrams, so plain to his mind's eye, that he will be able to see how every part of the machine does its work, and the reasons for our future statements regarding the indications of character that may be seen by an examination of the machinery that the mind uses in expressing itself. And, also, that he may the more clearly see the reasons for our conclusions regarding hygiene, self-culture and other subjects.

CHAPTER V.

CHARACTERISTICS OF THE MOTIVE TEMPERAMENT PEOPLE.

PHYSICAL FIGURE GIVEN BY THE MOTIVE TEMPERAMENT.

Persons of the motive temperament are tall and angular, rather than broad and plump. They usually have broad, square shoulders, and broad cheek bones, but in other respects they are characterized by length and not breadth of figure. Their bones are all large and prominent, consequently they have large hands and feet, with knuckles and other joints prominent and large. The largeness and prominence of the wrist joints is often a distinguishing feature of this temperament. The whole figure is characterized by strength and angularity instead of delicacy and smoothness. Its contour is marked by angles instead of curves. Persons of this temperament are usually large, but not always.

THE HEAD

is usually broad just above the openings of the ears and immediately back of them, and it is high at the crown.

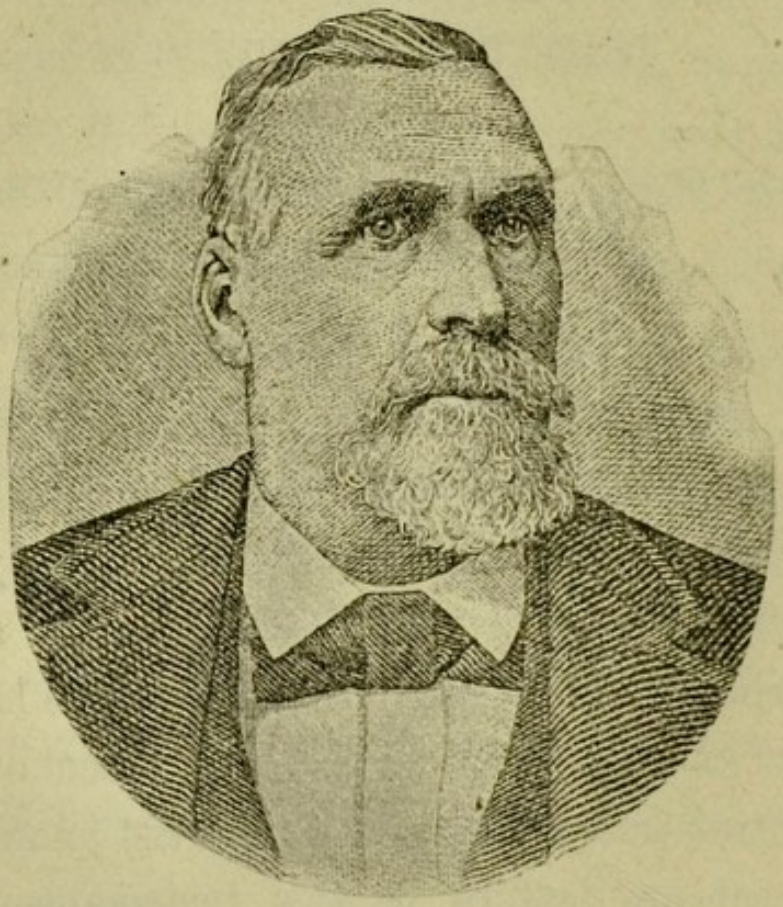

FIG. 6.

A TYPICAL MOTIVE TEMPERAMENT.

The hair is coarse, strong and wiry, and is most frequently dark and thick.

The nails are thick and strong. The

FACIAL APPEARANCE OF THE MOTIVE TEMPERAMENT

is characterized by the same prominence and angularity that distinguish other parts of the body. The forehead is usually high, but retreating, and the lower part is angular and projecting, and the eyebrows are frequently large and prominent. The cheek bones are broad, high and prominent, and the face is oblong rather than round, and the expression grave and often stern, rather than conciliatory or mirthful. The nose is a prominent one of some kind, and is most frequently of the Roman type. The chin is broad, strong and massive, and the angles of the jaw large and prominent. The eyes are usually dark, and the complexion often dark and swarthy. The front teeth are large.

THE REASONS WHY.

Now let us see why the motive temperament must give the physical appearance just described. One of the distinguishing features of this temperament is large bones. And large bones have large joints. And large joints must appear large and angular in the figure and features unless they are thoroughly covered by flesh. And if there is enough flesh to hide this angularity,

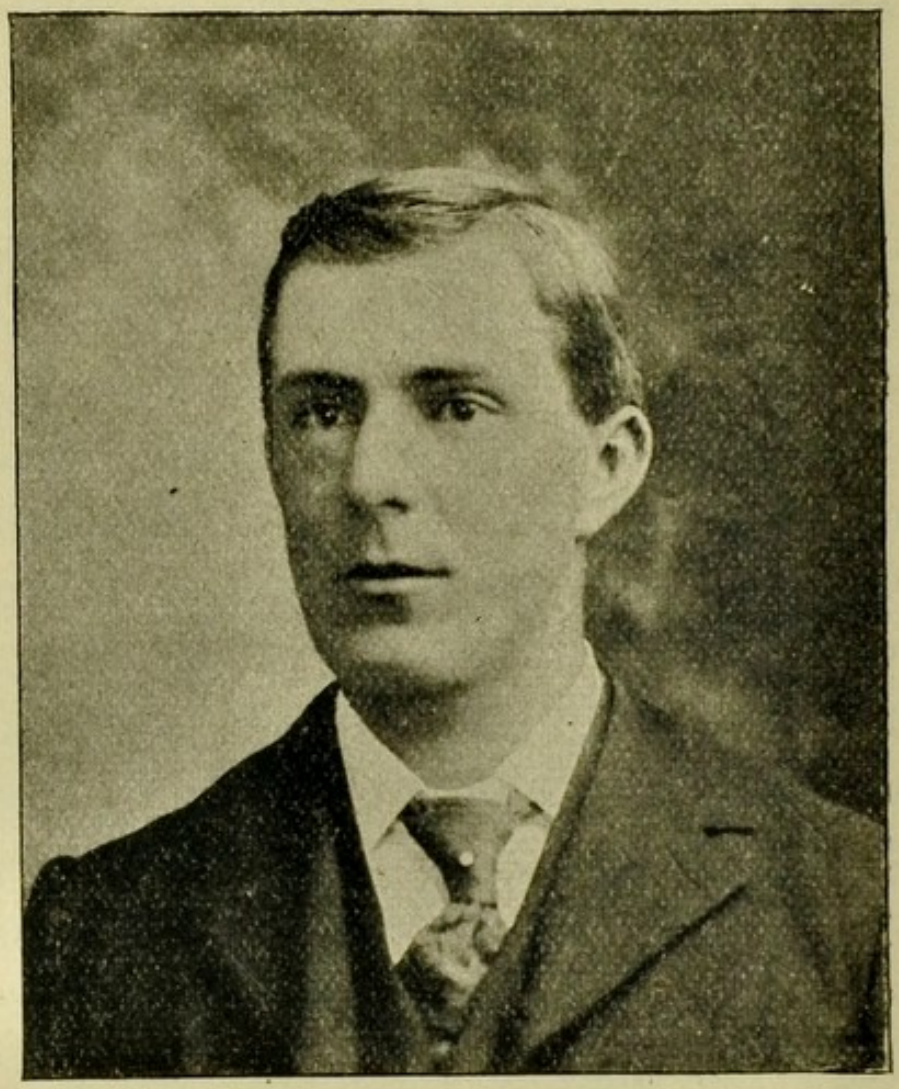

FIG. 7.

A MOTIVE TEMPERAMENT FACE,

remarkable especially for its extreme oblong contour. In this respect, it indicates the extreme type of the motive temperament. But in certain o her important particulars, it indicates only a modified type. Insufficient prominence of the cheek bones, and insufficient prominence or forward projection of the brows and the lower part of the forehead, and of the central portions of the face where Figs. 6 and 9 are especially prominent, are chief among the modifications that debar this face from the extreme motive temperament class.

the temperament is not the motive, because the flesh must be in larger proportion than the bones in order to hide large and prominent joints, and this large quantity of flesh gives a different temperament. The chin is broad and large, and the angles of the jaw large and prominent, simply because *all* the bones in the body are large, and these parts correspond with the rest. The cheek bones are broad, high and prominent for the same reason. They are merely the most prominent parts of large bones in the face.

LARGENESS OF BONES, COMPARATIVE, ONLY.

The largest men are those of the motive temperament. Some men of the vital temperament may weigh more because of their superabundance of fat. But those of the motive temperament have the largest frames. Yet a person may have the motive temperament and not be large. We say that a person of this temperament has large bones and muscles, but this largeness may be comparative, not actual. We mean that the bones and muscles are large in comparison with other parts of that person's body. They are in fact the largest part of his body, comparatively speaking. But they may be small as compared with the bones of another person. And the other person may have the vital or mental temperament. Many small men and women have the motive temperament. But the other

two classes of their organs are still smaller in comparison than are the bones and muscles. We take, then, as a standard of comparison, a person in whom neither class of organs is disproportionate in size and power as compared with the other two classes—a person who is harmonious in build and proportions. In estimating temperament, we keep this standard in the mind's eye, and if we find that the person examined, has bones and muscles that are larger in comparison to a harmonious standard, than are the other parts of the body, we know that it is a person of the motive temperament, and that the person is characterized by the qualities peculiar to that temperament. And the indications heretofore enumerated aid us in deciding whether or not the bones and muscles are larger in proportion than are the other parts of the body, because we know that they can not predominate in size without giving the angularity and prominence that we have described.

One of the fundamental principles in reading character is the following:

SIZE, OTHER THINGS BEING EQUAL, IS A MEASURE OF POWER.

This applies to every part of the brain, as well as to all other parts of the body. The modifying clause—other things being equal—relates to health, the intrinsic qualities, etc., and it applies more especially in com-

parisons between different individuals. Organs of the same size in two different persons, may be very different in power because of a difference in these modifying conditions. A sound oak tree is much more powerful than another of the same size that is diseased or partly dead and decayed. And a piece of oak timber is stronger than a piece of pine timber of the same size. But the different parts of an oak tree all possess the intrinsic qualities of oak. And unless certain particular parts are diseased, decayed or impaired in some way, one part has about the same strength as any other part of the same size. And if certain parts are defective, these defects can be easily seen.

The same principles apply to a man. One part of his body partakes of the same inherent qualities as all other parts. And the principle is then absolute, unless certain parts are diseased or injured, and if they are, such defects may be easily seen. So, for all practical purposes in estimating the strength of different organs in the same individual, we may apply the principle without modification, and estimate the relative strength in different parts of a person's body, by estimating the relative size of these parts. Applying this principle to persons of the motive temperament, we see that their greatest strength lies in the constituent elements of this temperament. Their bones, ligaments, cartileges, muscles and tendons are the parts of their bodies that

are comparatively most powerful, because they are comparatively the largest.

Another principle of equal importance, is the following:

POWER, OTHER THINGS BEING EQUAL, IS THE MEASURE OF ACTION.

This principle applies to all animals of every description. They naturally tend to exercise their strongest organs most. This is exhibited by rabbits, kangaroos and frogs in jumping; deer and greyhounds in running; lions, tigers and cats in rending with their claws; birds in flying; ducks, geese and fish in swimming; moles and groundhogs in burrowing. Cats fight with their teeth and claws, cattle with their horns, and horses with their hoofs. Each uses its strongest organs most, both in pleasure and battle. Man is no exception to this rule. It is easiest for him to exercise his strongest organs most, and this he naturally inclines to do. Consequently, in the absence of modifying circumstances or conditions, his distinguishing qualities are *always* those conferred by his largest organs. Men of the motive temperament will therefore be distinguished by the qualities that this temperament gives. Its constituent elements are the organs of locomotion, physical power and action. Hence, these are the qualities that distinguish persons of this temperament.

CHARACTER OF PERSONS WITH THE MOTIVE TEMPERAMENT.

These persons are strong, positive and aggressive. They enjoy hard work better than literature or any sedentary pursuit. They are often slow to form opinions and reach decisions, but when once fully decided, they adhere to their opinions very tenaciously, whether right or wrong. It is almost impossible to convince them that they are wrong, and it is hard for them to convince themselves and change their opinions. They are so firm, positive and tanacious that it is hard for them to let go even of an error. They are industrious and energetic. Their physical powers lie in the organs of motion and action, and they must use these powers in doing *something*. They are cool-headed, courageous and brave in times of danger, and naturally go to the front in war. They are straightforward, frank, open and aggressive, carrying out their designs by sheer force, energy and power, instead of trickery, "an oily tongue," or diplomacy. They like opposition and enjoy resistance. When they enter into an undertaking that proves more difficult than they had expected, instead of giving up discouraged, they redouble their efforts, and the greater the resistance offered, the more energy and power is brought to bear in overcoming it, and the more pleasure is experienced in the victory. They are

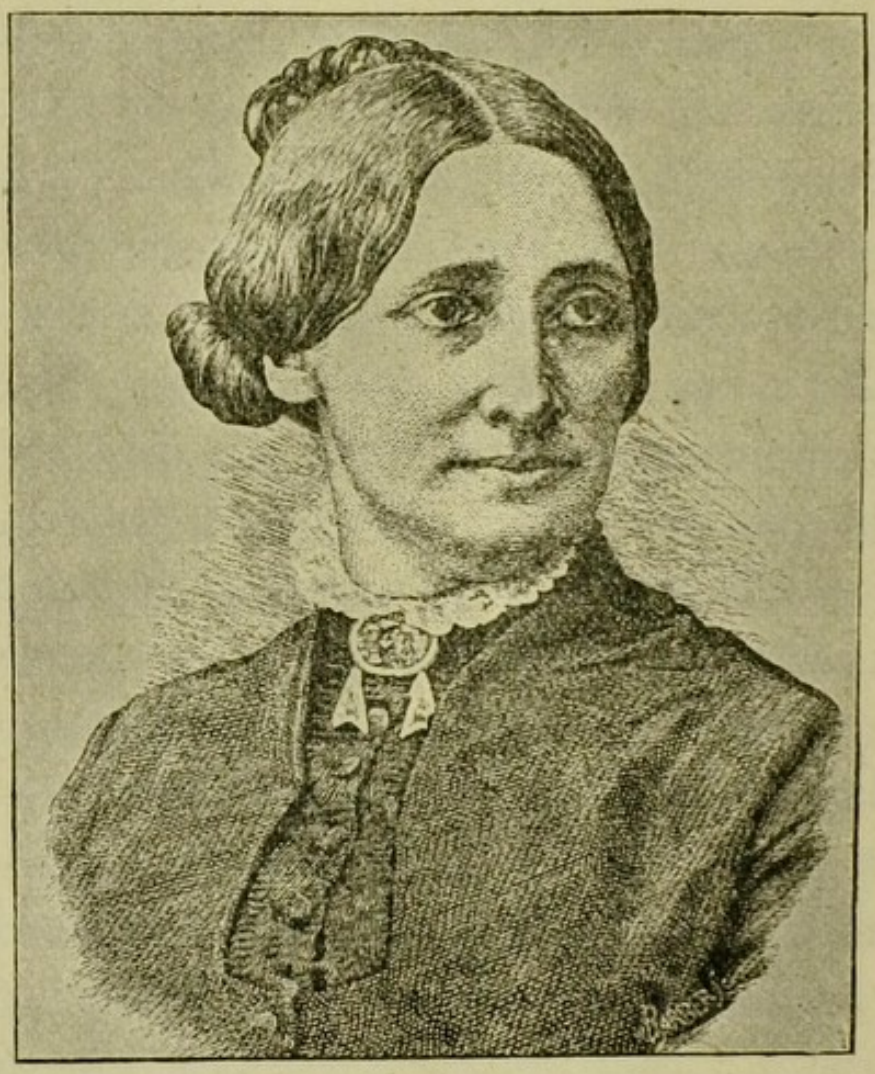

FIG. 8.

MRS. RUTHERFORD B. HAYES.

A decided motive temperament, modified by a good mental temperament, and a strong development of certain elements of the vital temperament.

persons of action, energy, courage, force, and open-hearted, straight aggressiveness and power. They are not diplomats, but accomplish their purposes by bringing forces to bear that are simply irresistible. They are deficient in secretiveness and policy, but pre-eminent in energy and power, and they use their strongest abilities in accomplishing their desires. They are slow to anger, but can be thoroughly aroused, and are then very powerful and vindictive. Their muscles are not always large, but are tough, strong, wiry and enduring. They have great physical strength and endurance, and very strong will power. They are self-reliant, ambitious and independent; more powerful than refined, and have more will power and courage than romance and sentiment; more hard, practical, "good common sense," than theory and imagination; are more inclined to out-door physical exercise than mental application or any kind of in-door confinement; they can execute better than plan, and are observers rather than philosophers or theorists; they are men of the field, rather than deliberative assemblages, and are found where railroads are being built, canals excavated or buildings erected; they are often at the head of armies and the execution of large contracts for important improvements; they love power, conquest and the achievement of large undertakings, and sometimes have such great love for excitement that they become reckless and im-

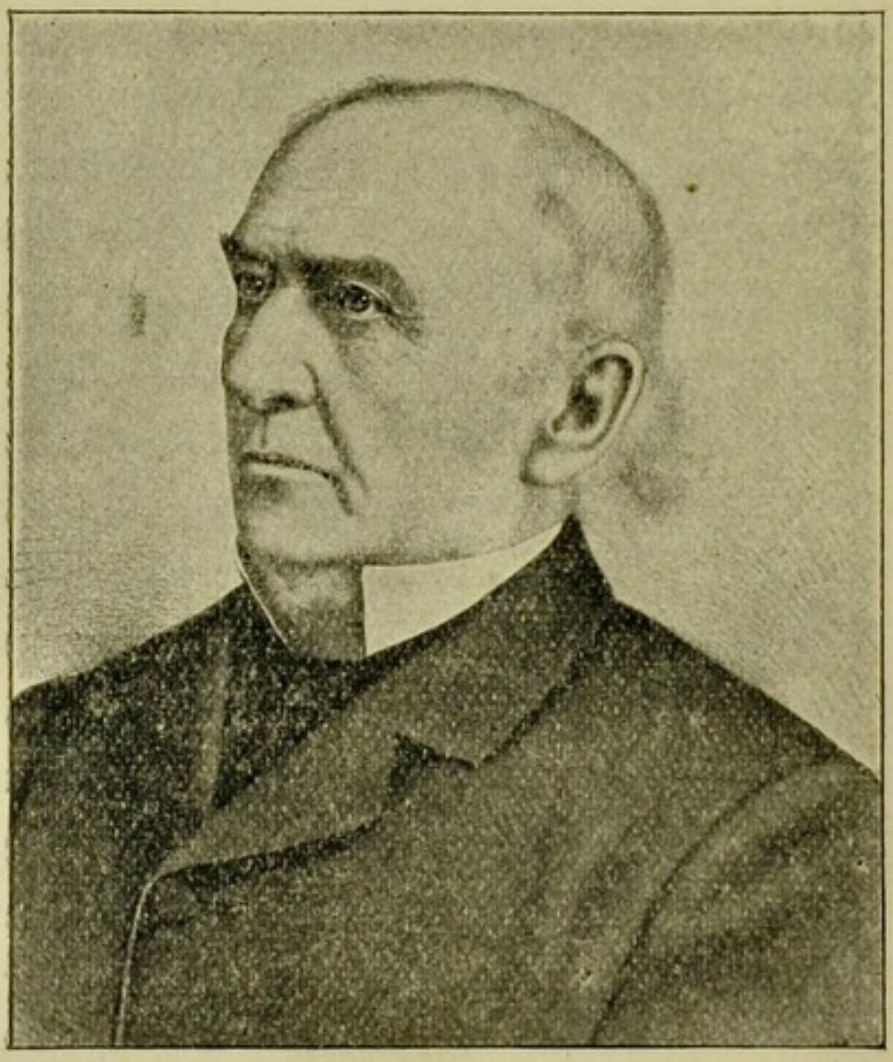

FIG. 9.

RT. HON. WILLIAM E. GLADSTONE,

late Premier of England. "The Grand Old Man." A typical motive temperament, modified by a superior mental temperament, and a decidedly good vital temperament.

prudent; as public speakers and in private conversation, they use strong expressions, emphasize many words, and talk direct to the point, with good, practical, strong common-sense, instead of sentiment and flowery expressions; they strike heavy blows and hit the nail square on the head, expressing themselves with a directness and power that is rendered doubly impressive by their strong base voice, and an earnestness and positive directness of manner; their physical movements are much like those of a draft horse—slow, but powerful and efficient; they are very greatly annoyed when compelled to give up beaten in a contest or undertaking, and will first exhaust every effort of an indomitable will and powerful physique.

These people must have plenty of fresh air and physical exercise in order to enjoy first-class health.

All of the characteristics just enumerated, and in the strength described, belong only to the

EXTREME TYPE OF THE MOTIVE TEMPERAMENT.

They belong to those in whom all elements of the mind, brain and physique combine to produce the character described. The great majority of persons with the motive temperament do not have *all* of its elements in the greatest degree of strength. There are myriads of men and women in whom the motive part of their machinery is stronger than any other part, but it is not

enough stronger to express all elements of the motive character in a marked degree. But the motive part of the mind's machinery *always* indicates the characteristics that we have enumerated, and their strength will be in exact proportion to the strength of the machinery through which they are expressed.

MODIFIED TYPES OF THE MOTIVE TEMPERAMENT.

A person in whom only a part of the physical elements of the motive temperament are developed in an extreme degree, or one in whom all of the elements are only a little stronger than are the elements of the other two temperaments, will necessarily evince the characteristics of the motive temperament only in a modified degree. But these characteristics are always evinced in some degree whenever this temperament is stronger than the other two. And the degree in which they are exhibited, is in proportion to the predominance of the motive temperament over the other temperaments.

PORTRAITS EXHIBITED.

Neither of the portraits that we exhibit indicates all of the elements of the motive temperament in an extreme degree, but they all exhibit an extreme type of some of these elements, and they all indicate beyond question that the motive temperament is much stronger

than either of the other two temperaments; and consequently, that the qualities peculiar to the motive temperament, were distinguishing characteristics of every one of the persons represented by these portraits. It may be that *all* of the distinguishing characteristics of a temperament, *never* resided in one person. And that the extreme type is therefore in a sense, ideal. But *all* of the elements are readily found in different persons, and each element always indicates the same thing.

DIFFERENT TYPES OF THE MOTIVE TEMPERAMENT

will be more fully explained in future chapters. Also certain modifications that the reader can much more easily understand after having investigated the vital and mental temperaments.

CHAPTER VI.

VITAL TEMPERAMENT.

The vital temperament supplies the force that operates the mind's machinery. It builds up the machine and keeps it in repair, and maintains its proper temperature. Food contains the requisite force and building materials and heat, and the organs of the vital temperament take these from the food, carry them to all parts of the body as they may be needed, and convey waste materials out of the body. This temperament in supplying force, is to the rest of the body, what the furnace, boiler, pumps, etc., are to an engine and the machinery that it runs. It is usually supposed that the

CHIEF USE OF FOOD,

is to supply building materials for the body. But it is our opinion, that the food utilized in supplying motive power, is a larger quantity than that required for building and repairing purposes. And that the greater part of the body's waste materials, are equivalent to ashes, cinders, smoke, etc., rather than broken down tissues of the body.

NECESSITY OF MOTIVE POWER TO OPERATE THE MIND'S MACHINERY.

It is just as absolutely impossible for the body to perform any of its functions without motive power, as it is for any other machinery to do its work under similar conditions. The brain cannot express thought, the heart beat, or stomach digest, without being acted upon by the requisite force. In the absence of force, it would be just as absolutely impossible for them to do their work, as it is for a bicycle, engine or water wheel to run without propelling power. Every thought we think, every movement of the body, uses force ; and a new supply must be furnished. Every idea that passes through the brain, every feeling of love or hate, of sadness or hope, every step we take, every wink of the eye, every breath we draw, expends vital force ; and it is a part of the work of the vital temperament, to maintain constantly a supply of this force, and to furnish all that is necessary for all requirement of all parts of the mind's machinery. The

FORCE THAT RUNS A STEAM ENGINE

is obtained from the coal, wood, oil, etc., that is burned in the engine's furnace. As the fuel is being burned it gives off heat, which is one form of force. The heat or force enters water contained in the engine's boiler, and converts the water into steam. As the combustion con-

tinues, and more and more heat is thus liberated from the fuel, it accumulates in the steam in larger and larger quantities; and when this accumulated power is applied to the proper parts of the engine's machinery, the engine at once begins to do its work. The firebox and boiler, therefore, are simply machinery used to take force from the fuel and convey it into water and thus generate the gas we call steam. And the advantage in doing this, lies in the fact that while the force is in the fuel, it is latent, and cannot be applied to the engine's machinery. But when it enters the steam, it is then active, and it can be applied to the machinery that sets the engine in motion.

SOURCE OF THE POWER THAT OPERATES THE MIND'S MACHINERY.

The force that runs the mind's machinery is taken from food that enters the body, and in practically the same manner as the force that runs a steam engine is taken from fuel that is consumed in the engine's firebox. The food, after being digested, enters the blood which carries it to all parts of the body. The food contains latent heat or force the same as fuel. As it is being carried by the blood through the body, it is slowly burned. This slow combustion of the food liberates its latent heat or force, which immediately becomes active, furnishing warmth to the body, and the motive power

to its various organs. It is the vital temperament that does all this work.

Science has seemed to prove that the

SOURCE OF ALL POWER

is the sun. Whether or not this is absolutely true in regard to *all* of Nature's forces, there can be no question concerning its truthfulness in regard to the subjects that we are discussing.

As plants of various kinds are growing, the sunlight is condensed in their fibers, where it remains latent until the plants disintegrate. As they decay or rot, they are being slowly burned and their heat is slowly lost. When they are consumed by fire, they disintegrate rapidly and their heat is rapidly lost. When an animal eats a plant, the force of the plant is partly used in furnishing motive power to operate the machinery of the animal's body, and part of the force is retained in the animal's tissues for future use. And when another animal eats the flesh of the first animal, the second animal appropriates the force stored up in the first animal's tissues, just as the first animal appropriated the force stored up in the fibers of the plants that it ate. In this way, the force that runs the mind's machinery is obtained either direct or indirect from the sunlight condensed in plants. And it is, therefore, organic matter, only, that constitutes the food of man.

INORGANIC MATTER

cannot sustain his life and energy. Carbonic acid, ammonia, etc., furnish food for lower types of life, but man requires a food composed of matter that has been organized, such as plants and the flesh of other animals. Disintegrated rocks, ammonia, phosphorus, etc., furnish part of the food of plants, and the sun furnishes the force necessary to their growth. But man cannot appropriate force direct from the sun. At all events, he cannot appropriate enough. He must secure his force by the disintegration of organic matter—fruits, vegetables, flesh, etc. If our bodies required as food, building materials, only, and they could appropriate their force direct from the sun as the plants do, perhaps we could be nourished by the same kinds of food that plants are. But such is not the case. We must secure

BOTH FORCE AND BUILDING MATERIALS

from the food that we eat, and all of this work is done by the organs that constitute the vital temperament.

There is no doubt about a large part of our food being used to build up the body. And in all probability, a large part of our force comes from the disintegration and combustion of tissues that have formed a part of our own bodies. That much of our food is used first to build up various parts of the body, and when these parts are broken down and disintegrate, it is again used, and

this time, to furnish force to the body. But it is only a part of the force required for the body that is supplied in this way. In

ANALYZING THE BODY'S TISSUES,

of course we find inorganic matter; and much weakness and sickness no doubt results from a deficiency of some important inorganic constituent that can be supplied in the form of medicine. But, as a rule, our food must be composed of organized matter. And one of the most important reasons of this, is the necessity for force and heat as well as building materials.

Just exactly

HOW FORCE ACTS UPON MUSCLES

and the various organs of the body, and enables them to do their work, does not seem to be positively known in every particular. But there are many interesting features connected with this work, that are understood, and we will discuss a part of them in future pages. And we will now enter into a

DETAILED EXAMINATION OF THE VARIOUS ORGANS OF THE VITAL TEMPERAMENT,

and will study the manner in which each contributes to the entire work done by this part of the mind's machinery.

The following diagram exhibits a list of the principal organs of this temperament:

ORGANS COMPOSING THE VITAL TEMPERAMENT.

- DIGESTION,
  - Salivary Glands,
  - Stomach,
  - Liver,
  - Pancreas,
  - Duodenum,
  - Small Intestine.
- CIRCULATION,
  - Heart,
  - Arteries,
  - Veins,
  - Lymphatic Vessels.
- RESPIRATION,
  - Nasal Passages,
  - Trachea,
  - Bronchial Tubes,
  - Lungs,
  - Skin.
- DEPURATION.
  - Lungs,
  - Liver,
  - Skin,
  - Kidneys,
  - Large Intestine.

CHAPTER VII.

DIGESTION.

Let us imagine ourselves seated before a table bountifully spread with nicely prepared bread, flesh, fruits and vegetables. The food before us contains the heat, force and building materials necessary to the health, power and comfort of a hungry man. But how are these properties to be taken from the food and utilized by the man? This question we will attempt to answer and show what part of the work is done by each individual organ of the vital temperament.

Conveying food to the mouth, and crushing and grinding it between the teeth, is work done by the motive temperament. But while the food is being reduced to small particles by the teeth,

THE SALIVARY GLANDS

are pouring saliva into it. This is the beginning of the work done by the vital temperament. Part of the salivary glands are located beneath the tongue. Others are in front of and beneath the ears. Those near the ears are the parts that become swollen in mumps. All of these glands have ducts that lead into the mouth from the glands, and the ducts carry the saliva.

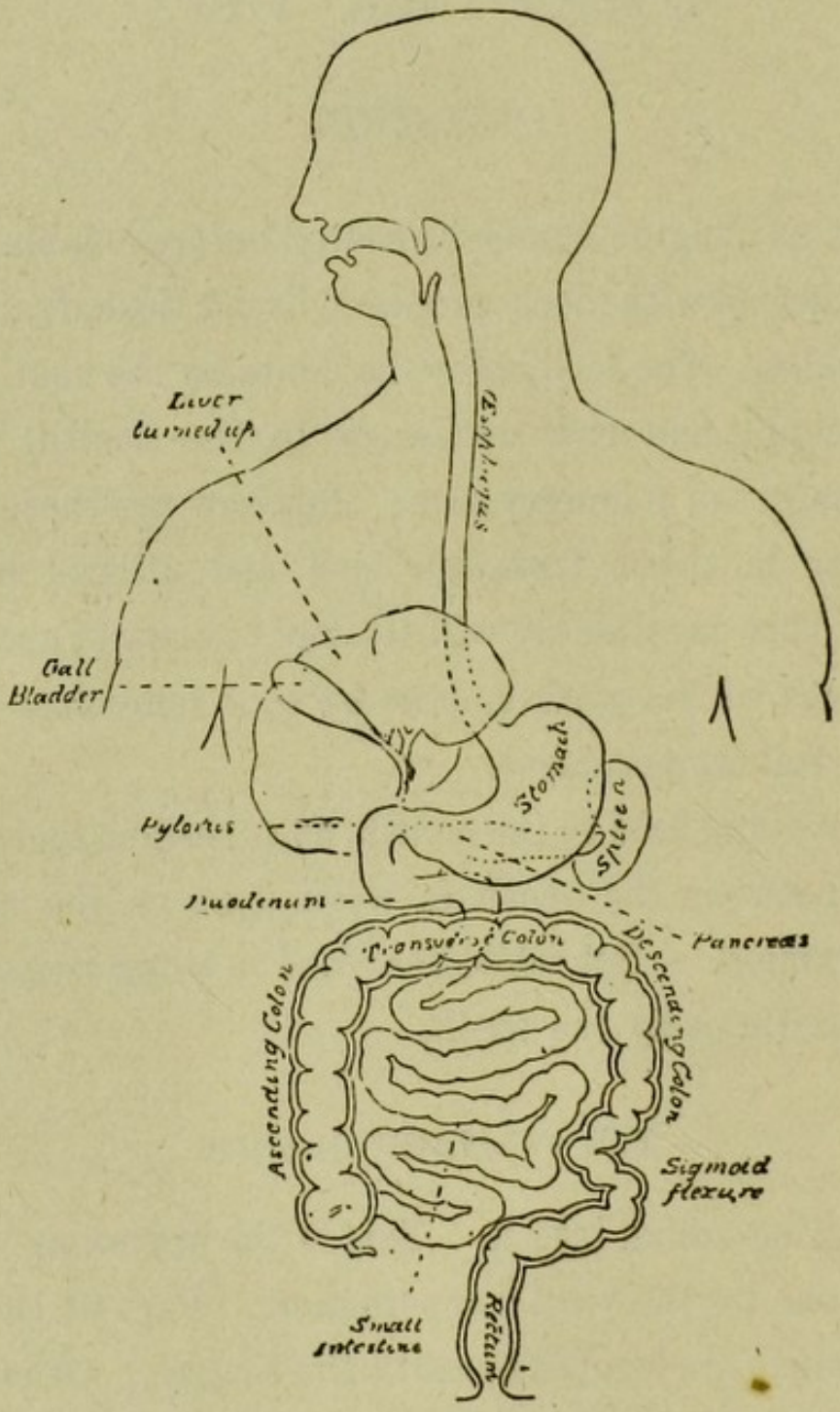

FIG. 10.

DIGESTIVE ORGANS.

WHAT A GLAND IS.

A gland is an organ that manufactures something from materials that it takes from the blood. The salivary glands, take from the blood the necessary ingredients and manufacture saliva. The liver is the largest gland in the body. It manufactures bile from the blood that flows through it. The pancreas manufactures pancreatic fluid. The glands are all supplied with large blood vessels that convey large quantities of blood through them, from which each gland extracts the materials necessary to the manufacture of its own particular product.

ALKALIES AND ACIDS

are two great classes of chemicals. Each possesses the power to dissolve certain kinds of matter. An alkali will dissolve some things, and acids dissolve others. Some things may be dissolved by either. But many things that are dissolved by one of these chemicals, cannot be dissolved by the other.

HOW SALIVA AIDS DIGESTION.

The saliva is an alkaline chemical, and it aids digestion by moistening and lubricating the food, and in dissolving certain parts. This explains why our food should be thoroughly masticated and the saliva mixed with every particle. If the food is not reduced to

small particles, it cannot be thoroughly acted upon by the saliva, and part of the digestive process will not be properly performed. And no other part of the digestive system can accomplish this work so well as it can be done by the organs of the mouth. This truth becomes more plain when we consider that there is no less than an average of about three pints of saliva secreted each day. The economies of the body require this to be thoroughly mixed with the food. When the chewing is but partly done and the food is swallowed in large pieces, perhaps washed down by a drink of some kind, its proper mixture with the saliva is impossible. The *tongue* renders some assistance to digestion by its aid in holding the food between the teeth and in mixing it with saliva and in swallowing.

THE ŒSOPHAGUS

is a long tube leading from the mouth to the stomach. The food passes through this tube in the process of swallowing. Its walls are provided with muscles that relax in front of the food and contract and decrease the diameter of the tube behind it, and thus force the food into the stomach. This is a mechanical process, and the œsophagus aids digestion only by conveying the food from one part of the digestive system to another.

THE STOMACH

is a very important part of the digestive system. Its work is both mechanical and chemical. It is a kind of bag or sack that holds about three pints. This bag—the walls of the stomach—is partly composed of three

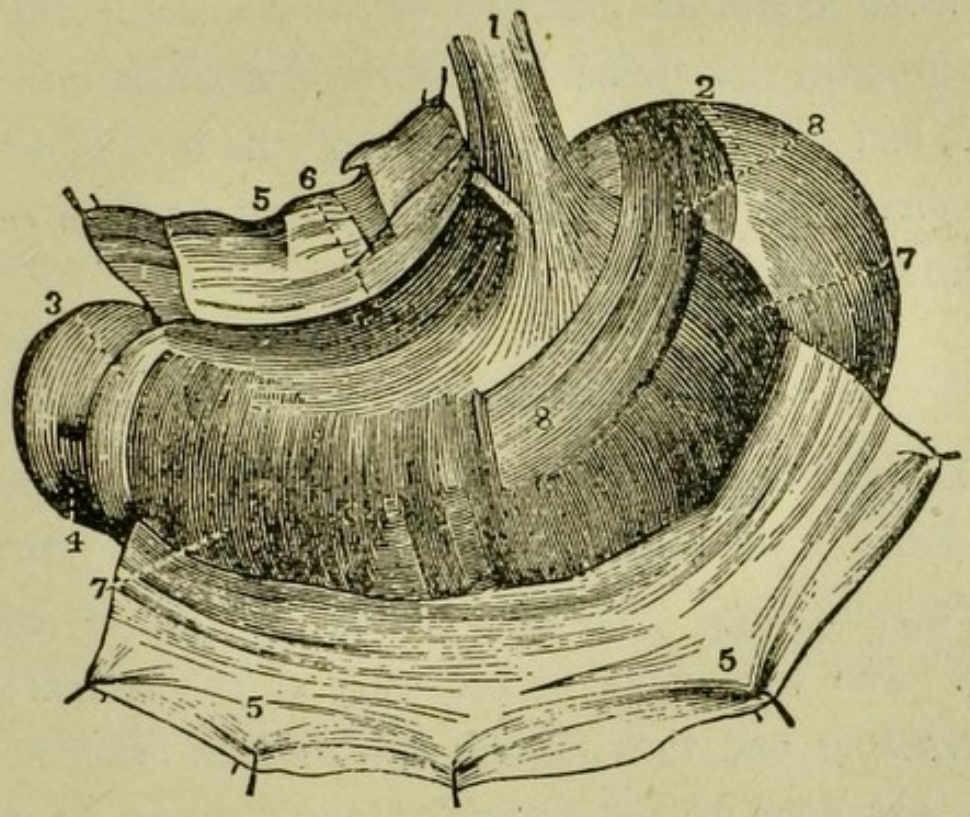

FIG. 11.

Stomach with outside of walls, 5, 5, 5, partly r moved, exposing the muscular layers beneath: 1, œsophagus; 4, the end of stomach that opens into the duodenum; 6, longitudinal muscular fibers; 7, circular; 8, oblique.

layers of muscles that pass around the stomach in three different directions. Each layer has the power to contract and relax independent of the others. And in the process of digestion, these layers of muscles alternately

contract and relax. This alternately decreases and increases the diameter of the stomach in all of its different parts. One set of muscles contracts and squeezes the food and forces it into other parts of the stomach, and then the first layer relaxes and another contracts, and the food is then squeezed in another direction, and is forced to still another part of the stomach. During this process, the stomach is pouring its juices into the food, and the constant squeezing of the food in different directions, thoroughly mixes every particle of it with the fluids of the stomach. The

GASTRIC JUICE

is the most important of these fluids. It is secreted by glands in the stomach's walls, and is poured into the stomach in large quantities during its work of digesting. The work done by the walls of the stomach in contracting and thus mixing the food, is mechanical. But that done by the gastric juice, is chemical. The gastric juice is acid, and it dissolves certain particles of food that the saliva cannot. During digestion, the food becomes more and more fluid in its consistency, and the constant churning motion produced by the contraction and relaxation of the stomach's walls, is constantly mixing every particle of the food with the juices of the stomach, and the food becomes dissolved more and more as this work continues. And when part

of the food is digested, it is taken up by little veins in the walls of the stomach, and is mixed with the blood and carried along with it in the course of its circulation. (Veins are vessels that carry blood towards the heart.)

But the stomach cannot complete digestion. There are parts of food that it cannot reduce. These pass out of the stomach and into the

DUODENUM,

where the work of digestion continues. The duodenum is sometimes called the second stomach. It is really the beginning of the small intestine. Its length is supposed to be about the breadth of twelve fingers, hence its name. Its mechanical action is similar to that of the stomach, but its chemical action is very different. It is in the duodenum that the liver and pancreas assist digestion by pouring

BILE AND PANCREATIC FLUID

into the food. These have chemical effects different from the saliva and gastric juice, and they dissolve parts of food that the saliva cannot. The bile and pancreatic juice are both alkaline. The former, slightly so; the latter, decidedly. And their action upon food is decidedly different from that of saliva and gastric juice, although the former is also alkaline. One of the most

marked effects of the pancreatic juice, is the digestion of fats.

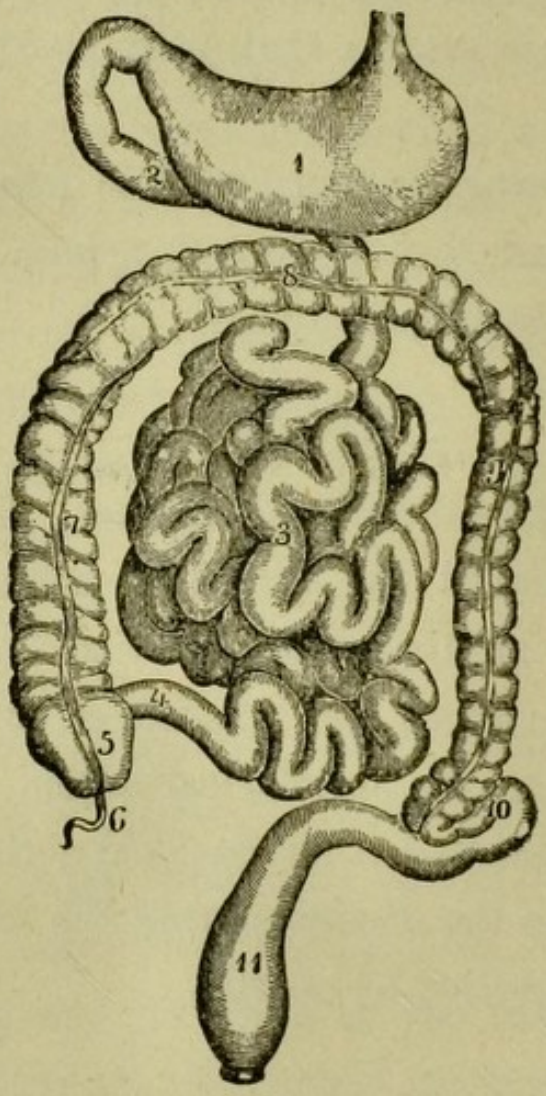

FIG. 12.

Stomach and intestines: 1, stomach; 2, duodenum; 3, small intestine; 4, end of small intestine that connects with large intestine; 6, vermiform appendix; 5, 7, 8, 9, 10, 11, large intestine; 10, sigmoid flexure; 11, rectum.

THE LIVER

not only assists digestion, but it also contributes to the body's health and vigor by extracting the bile and cer-

tain impurities from the blood; and when the liver becomes torpid and sluggish, and fails to properly do its work, the blood becomes impure and the health suffers. The skin and the white part of the eyes become yellow, and the brain and other parts of the body cannot properly perform their functions, because the blood necessary for their work, is inferior in quality.

Very large blood vessels enter the liver, and large quantities of blood circulate through it. The blood vessels divide and subdivide in the liver, until they form a net-work of very small branches, communicating with cells. From the blood in these numerous cells, the liver extracts the bile, and it passes into the gall bladder where it remains until it is conveyed through the gall duct and emptied into the duodenum.

THE PANCREAS

is an organ that physiologists do not understand very well, except in its aid to digestion. Whether or not it ever becomes sluggish like the liver, and if so, what effect this torpidity has upon the general health, is not very well known. Its work is done in about the same manner as that of other glands, only, it extracts the necessary ingredients from the blood and manufactures pancreatic fluid instead of some other product.

After the duodenum has finished its mechanical action upon the food, and the bile and pancreatic juice have

had their chemical effects, the food is then pretty thoroughly reduced to very small particles, and is in the form of a white fluid that looks very much like milk. It then passes into the

SMALL INTESTINE.

This is a long tube leading from the duodenum to the large intestine. Its average length is about twenty feet, and it is an inch to an inch and one-half in diameter. Its walls are partly composed of two layers of muscular fibers. One layer extends lengthwise along the bowel, and the other is circular and passes around it. During digestion, these have a mechanical action similar to the muscles in the walls of the stomach. They alternately relax and contract. This gives the bowels a worm-like motion and forces their contents downward. When the bowels of a cat or other animal are exposed during intestinal digestion so that they can be seen, they look like a number of great worms or snakes crawling among each other. Throughout the entire length of the intestine, it secrets and pours into the food a fluid that seems to combine the action of all the other digestive fluids, acting upon all kinds of food and completing the work of digestion.

ABSORBENT VESSELS.

When the food is digested, part of it is taken up

by the veins of the intestine and it immediately mixes with the blood and circulates with it just the same as that absorbed by veins in the stomach. Another part of the digested food in the intestine, is absorbed by the lymphatic vessels, and it circulates through them before it enters the veins and mixes with the blood.

But the digested food all reaches the blood sooner or later, by one route or another. And the

OBJECT OF DIGESTION,

is to so prepare the food that it may pass into the blood together with its building materials, and its store of latent heat and force, and be carried with the blood to all parts of the body.

Food that the small intestine fails to digest, and indigestable things that are swallowed with the food, pass from the small intestine into the

LARGE INTESTINE.

This organ retains waste materials and carries them out of the body, but it has very little if any thing to do with digestion. Food that is not digested before it reaches this organ, is not digested at all. The large intestine will be more fully described in discussing the depurative organs.

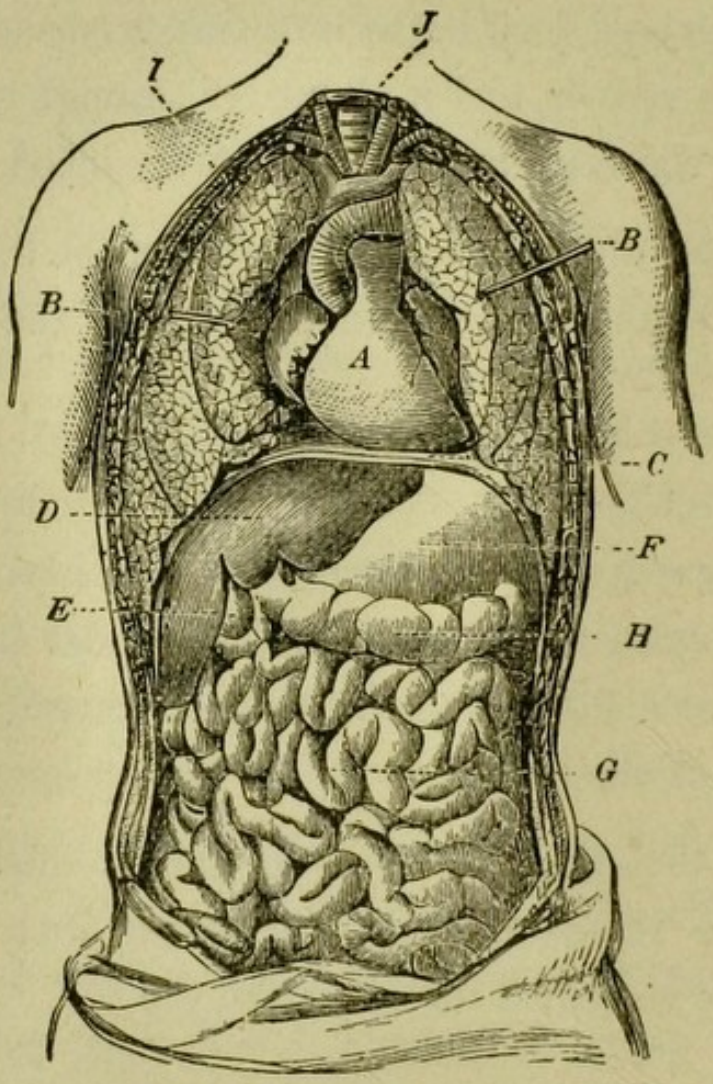

FIG. 13.

Front view of the organs within the trunk, showing their relations to each other, and the position that each occupies. *A*, heart; *B*, lungs drawn apart to show the heart and blood vessels connected therewith; *C*, diaphram separating chest from abdomen; *D*, liver; *E*, gall bladder; *F*, stomach; *G*, small intestine; *H*, transverse part of large intestine; *J*, trachea.

CHAPTER VIII.

CIRCULATION.

Having examined the process by which the food is reduced to such consistency that it can be taken up by the absorbent vessels and mixed with the blood, we will now follow it in its course through the circulatory system.

The absorbent vessels of the stomach and bowels that take up the food as it is digested, are microscopic in size. But they unite with each other as they pass from the inside of the digestive organs, and thus form larger vessels, in the same way that brooks and creeks unite and form rivers. The veins that absorb the food, continue to unite with each other until they form one large vein called the

PORTAL VEIN.

This vein flows into the liver and carries the food that has been absorbed by the veins. (See Figs. 14, 15.) The food undergoes some changes by being mixed with the blood. In the liver it flows through veins that divide and subdivide until they are microscopic in size and communicate with the cells of the liver. In these cells still further changes are wrought in the blood and the

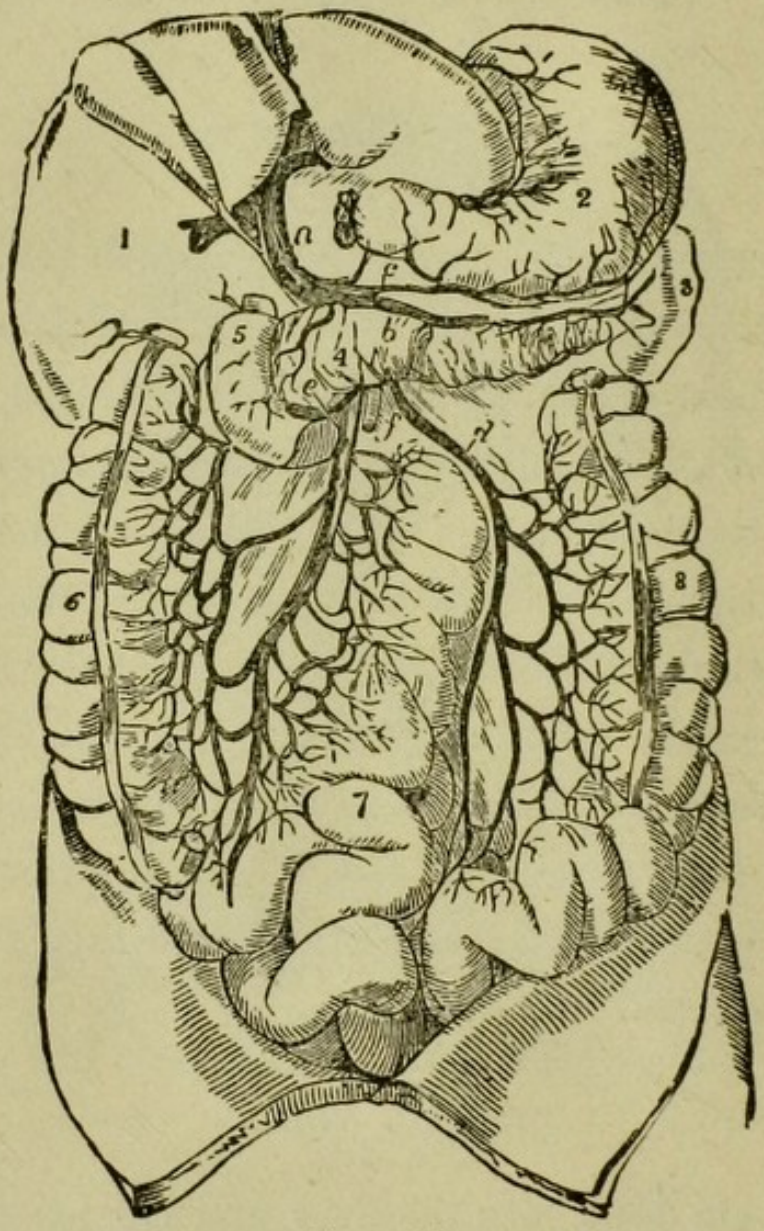

FIG. 14.

The portal vein and its principal branches, together with the liver and the organs which contain the capillaries that form these veins. 1, liver; 2, stomach, from which duodenum has been removed; 3, spleen; 4, pancreas; 5, part of duodenum; 6, 8, parts of colon, the transverse portion of which has been removed; 7, small intestine. *A*, portal vein; *b*, *c*, *d*, *e*, branches of portal vein. The branches originating in stomach and small intestine, are those that convey the digested food into the portal vein.

food contained therein, and certain impurities are removed. The blood is then gathered together in veins that continue to converge until they all unite into one large vein that flows into the heart. The work of the

LYMPHATIC VESSELS

in conveying digested food into the general circulation, is quite similar to that done by the veins. Innumer-

FIG. 15.

Diagram designed to illustrate the circulation of food and blood from the intestine to the liver. 1, 1, 1, 1, 1, the capillaries and veins that originate in the intestine and converge to form the portal vein, 2; 3, 3, 3, veins into which the portal vein divides and sub-divides in the liver.

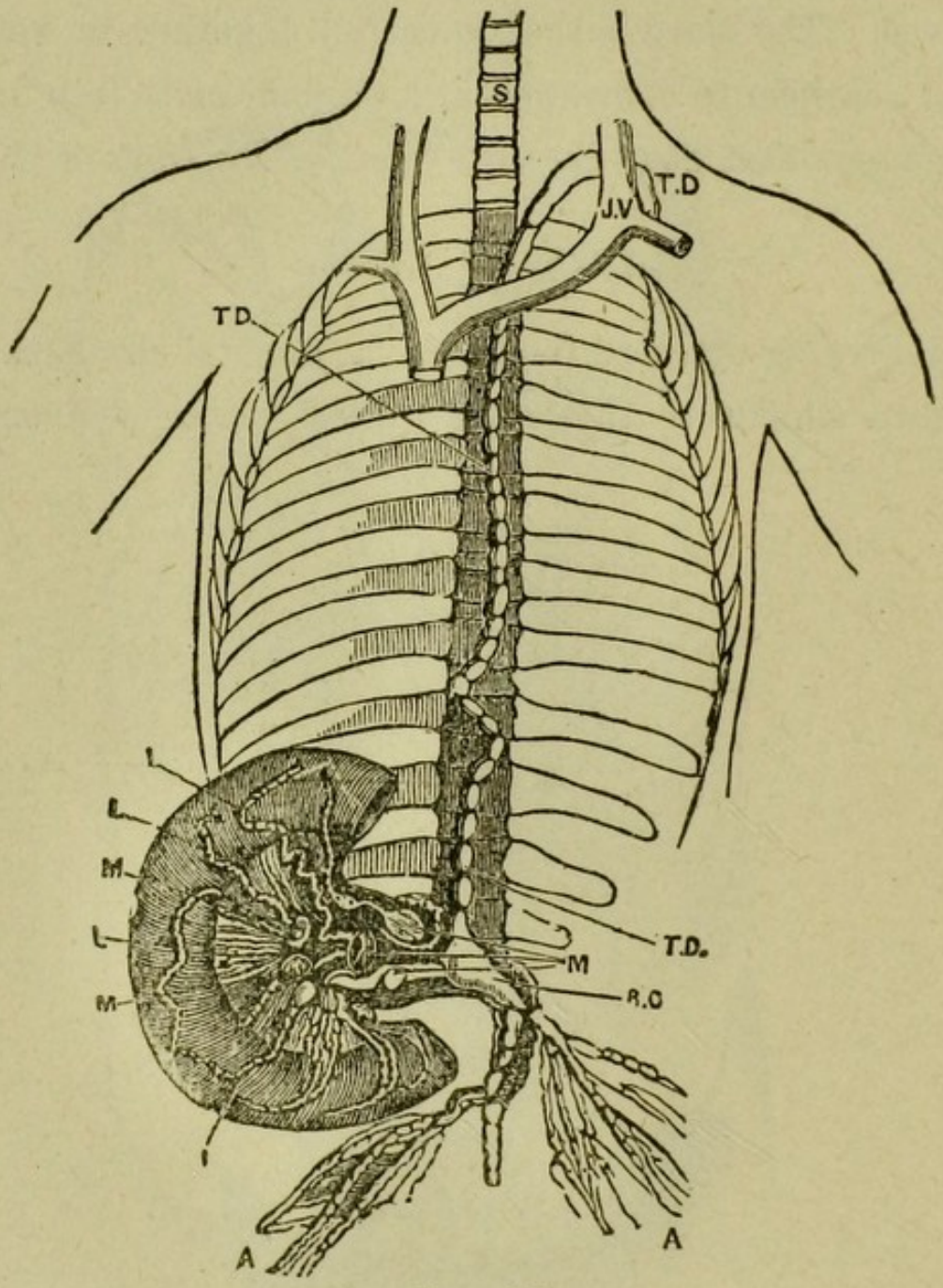

FIG. 16.

Route of the digested food that is absorbed by the lacteals and sent through the thoracic duct to a vein in the neck. *L*, *L*, *L*, lacteal vessels originating in a small part of the intestine; *M*, *M*, *M*, glands that the lymphatic vessels pass through; *R*, *C*, receptaculum chyli; *A*, *A*, other lymphatic vessels; *T*, *D*, *T*, *D*, *T*, *D*, thoracic duct, originating in the receptaculum chyli and extending upward along spine, *S*, and terminating in the left sub-clavian vein.

able microscopic vessels are located in the lining membrane of the intestine, side by side with the minute veins. The mouths of these little lymphatic vessels (the lacteals) drink up the milk-like fluid in the intestine. The little vessels converge and form larger vessels, and they also unite with each other and eventually form one large vessel called the *receptaculum chyli*, which flows into the

THORACIC DUCT.

The thoracic duct is about the diameter of a goose-quill. It lies in front of the spine, terminating in a large vein in the neck. (See Fig. 16.) The part of the digested food that is taken up by the lymphatics, flows through these vessels and commingles with the blood after reaching the vein before mentioned. From this point, the blood and digested food pass together through a large vein—the vena cava descending—and enter the heart. Here they commingle with the food taken from the digestive organs by the veins, and also with the blood from all parts of the body.

THE HEART

is the organ that measures or regulates the circulation of the blood, and assists in forcing it to all parts of the body. For a long time it was considered a kind of an engine or force pump that imparts the entire impulse

that causes the blood to flow through the body. But it is now known that other forces assist in keeping the blood in motion, and that one of the most important

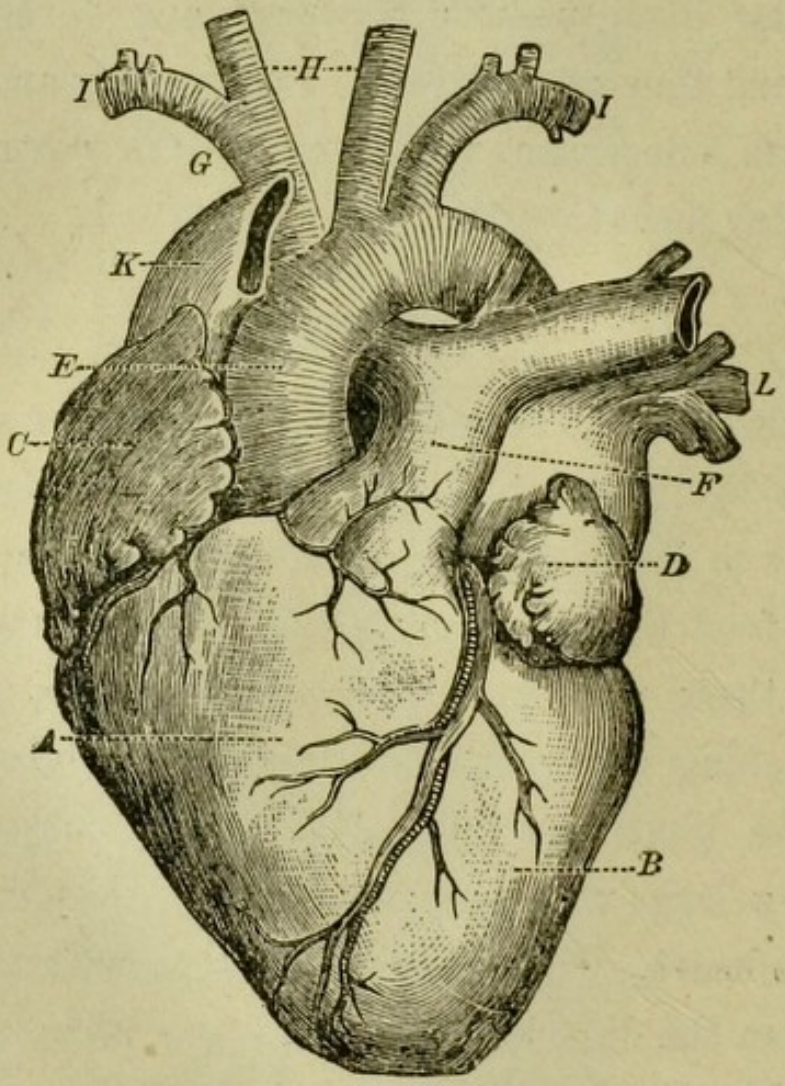

FIG. 17.

The heart and the blood vessels connected therewith. *A*, right ventricle; *B*, left ventricle; *C*, right auricle; *D*, left auricle; *E*, aorta; *F*, pulmonary artery; *G*, *H*, *I*, *I*, branches of aorta that lead to head and arms; *K*, vena cava; *L*, pulmonary veins.

functions of the heart, is to regulate the quantity of blood that circulates through the body in a given time.

APPEARANCE AND POSITION OF HEART.

The heart is a pear-shaped muscle about as large as the fist. It hangs, point downward, just to the left of the chest's center. It is the small end of the heart striking against the walls of the chest, that causes the heart-beat. The center of the beat, will therefore locate the heart's point. There are four chambers in the heart. In the adult, each holds about a wine-glass full. Two of these chambers are on each side, one above the other. Those on each side communicate with each other, but not, in adult life, with those on the opposite side. The two upper chambers are called

AURICLES,

because their walls are supposed to resemble a dog's ears (aures, ears). It is the right auricle that receives the venous blood from all parts of the body. The digested food absorbed by the veins from the stomach and intestine, together with the blood from the liver, and the digested food absorbed from the intestine by the lymphatic vessels, together with all lymph carried through the thoracic duct, and the blood gathered by the capillaries and veins from all other parts of the body, all meet and commingle in the right auricle. It is, therefore, a reservoir for the collection and temporary retention of digested food, lymph and venous blood

from all parts of the body. From the right auricle the blood passes down into the chamber below. The two lower chambers of the heart are called

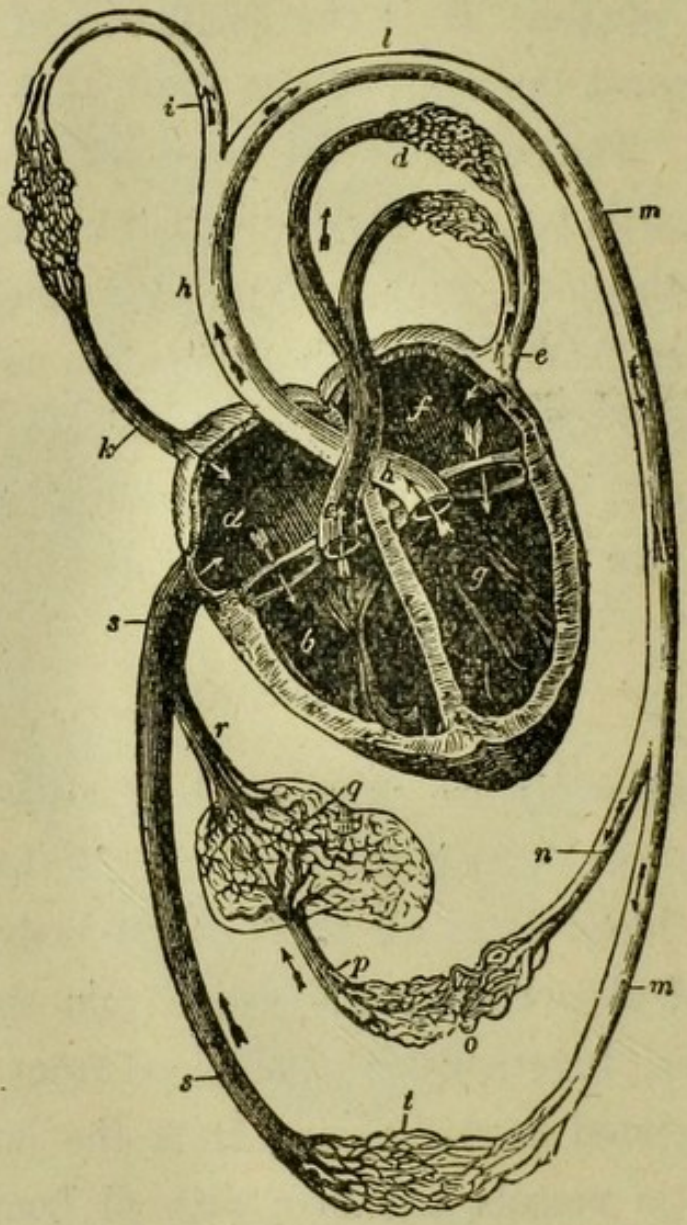

FIG. 18.

Diagram designed to illustrate the circulation. The chambers of the heart, in their positions and relations to each other, the blood vessels at their points of connection therewith, and the course of the blood as indicated by the arrows, are all about correct. But in other respects, the diagram is intended only to convey an idea of the circulation,

VENTRICLES.

From the right ventricle, the blood passes into the lungs, and after circulating through them, it returns to the heart. But this time it gathers in the left auricle instead of the right. It then passes into the left ventricle, which assists in sending it to all parts of the body.

We will now investigate a little more about the

HEART'S ACTION.

This consists of an alternate contraction and expansion. When the muscles forming the walls of the heart, contract, they close its chambers. And when they relax or expand, the chambers are opened. When the heart expands or opens its chambers, the blood flows in. And when it contracts and closes them, the blood is forced out. As the force required to cause the blood to flow from the auricles down into the ventricles, is not very

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and not to show the correct positions of the organs. *a*, right auricle; *b*, right ventricle; *c*, pulmonary artery with its two branches, one of which extends to the right lung, and the other to the left; *d*, capillaries in the lungs; *e*, pulmonary veins; *f*, left auricle; *g*, left ventricle; *h*, aorta; *i*, arteries; *k*, superior vena cava; *l*, arch of the aorta; *m*, descending portion of aorta; *n*, arteries of stomach and intestines; *o*, capillaries of stomach and intestines; *p*, portal veins; *q*, capillaries within the liver; *r*, veins leading from liver to inferior vena cava; *s*, inferior vena cava; *t*, capillaries of abdomen, lower limbs and feet. The capillaries represented in the upper portion of diagram, at the left, belong to the head, brain, arms and hands.

great, the muscular walls of the auricles do not need to be very strong, and they are consequently not very thick. Much greater force being required to send the blood through the lungs, and to all parts of the body, the propelling machinery that does this work, must be more powerful; consequently, the walls of the ventricles are much thicker, and their contractions much stronger, than those of the auricles. This is true especially of the left ventricle, which does a large part of the work required to send the blood all over the body.

VALVES OF THE HEART.

To insure the blood always flowing *forward*, the entrance and exit of each ventricle is provided with valves. When a ventricle contracts, the valves at its entrance are closed, and those at the exit, opened. When it expands, those at its entrance are opened, and those at the exit, closed. This prevents the blood from flowing backward, and insures its movement forward in the right direction.

The veins are also provided with valves that prevent the blood from flowing in the wrong direction.

The tubes or vessels that carry the blood away from the heart and distribute it to all parts of the body, are called

ARTERIES.

Their walls are strong, firm and elastic. When the left

ventricle contracts and forces the blood into them, they are somewhat distended. Afterwards they slowly contract, and thus assist to keep the blood moving until the heart again contracts and furnishes a new impulse to the onward motion of the blood. Bleeding from an artery is much more dangerous than from a vein, because of the greater force propelling the arterial blood. The arteries, therefore, need greater protection than the veins, and they are, as a rule, located deep in the body and well covered by other tissues, while the veins are near the surface.

PULSE.

In the wrist and at the temples, however, there is not enough flesh to cover the arteries very thoroughly, and in these parts, a distinct pulsation can be felt by the fingers as the stream of blood beneath them receives a new impulse and expands the arteries at each contraction of the left ventricle. The blue lines that can be seen under the skin in different parts of the body, are veins.

The blood leaves the left ventricle in one large artery about half an inch in diameter, called

THE AORTA.

As the aorta leaves the heart, it extends upward. But it soon gives off large branches that lead to the

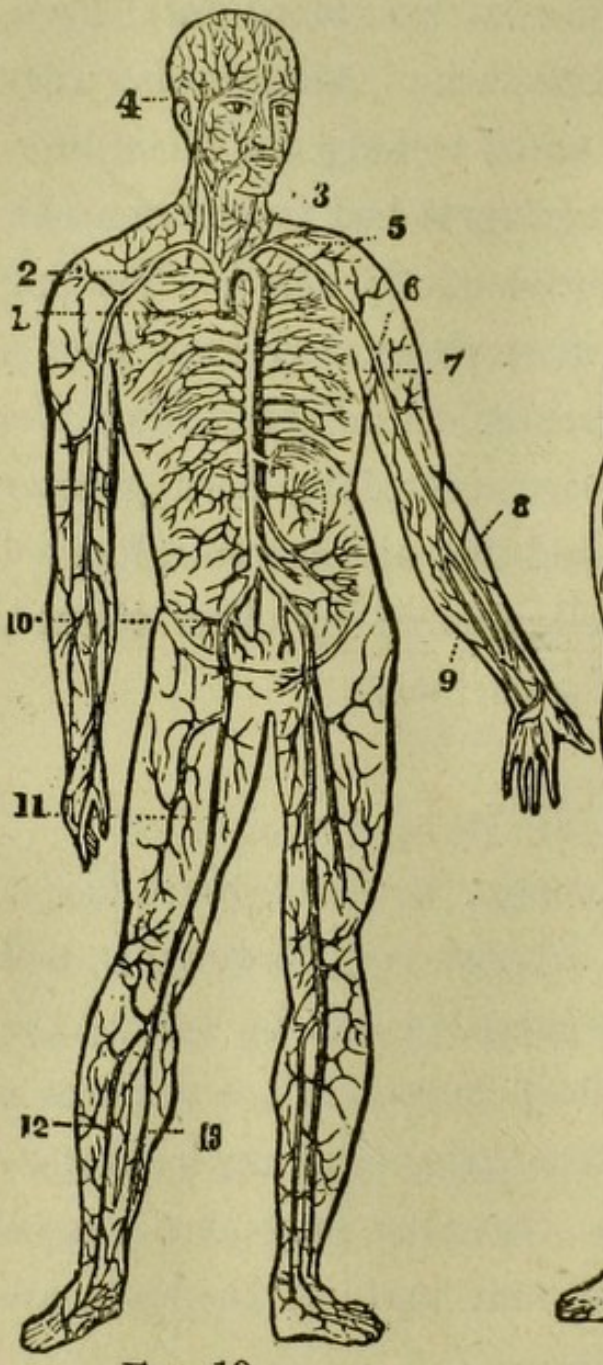

FIG. 19.

The aorta and its principal branches. 1, aorta near the heart; 2, arch of aorta; 3,4, arteries that supply blood to the brain and head; 5,6, 7, 8, 9, arteries that distribute blood to the shoulder, arm and hand; 10, 11, 12, 13, arteries that supply blood to the lower limbs.

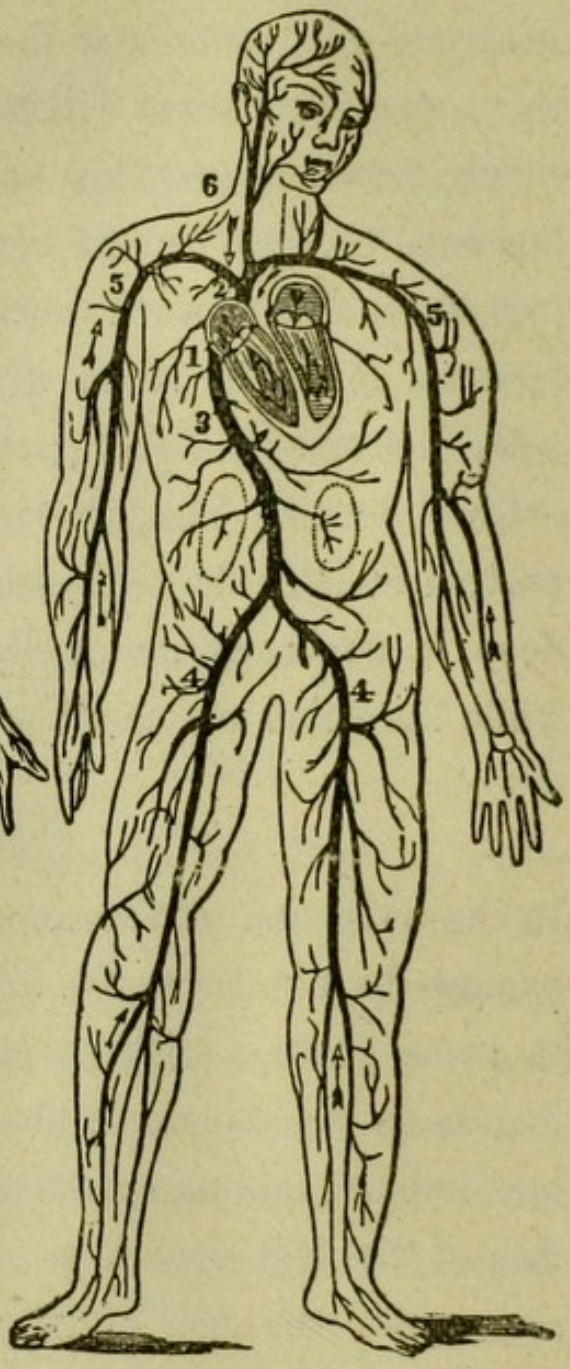

FIG. 20.

Vena cava and its principal branches, together with a few of the smaller veins. 1, right auricle of the heart; 2, vena cava descending; 3, vena cava ascending; 4, 5, 6, larger branches of the vena cava. The arrows indicate the direction that the blood flows.

head, brain and arms, and at this point it makes a bold curve and descends through the chest and abdomen, dividing and sub-dividing like the branches of a tree, until its divisions are practically innumerable; and together with the branches distributed to the upper parts, they penetrate every point in the body. (See Fig. 19.) The

CAPILLARIES

are the innumerable minute branches into which the arteries divide. They are of hair-like proportions, are located in all parts of the body, and connect the arteries and veins. The beginning of each capillary is a minute artery, and its terminal part is a minute vein. But just where it ceases to be an artery and becomes a vein, is almost impossible to tell. The capillaries penetrate every nook and corner of the entire body, distributing the blood so thoroughly that it is impossible to find a single point where there is no blood. If the finest needle is thrust into the flesh, it will cause a flow of blood; and the reason the blood flows, is because a blood vessel is opened. These minute vessels are so very close together, that it is impossible for the finest needle point to pass between them. It is, therefore, impossible for a needle to enter the flesh without penetrating one or more of them, and this injury causes the bleeding. The little

VEINS

formed by capillaries, unite with each other, and the larger vessels thus formed also unite and form still larger, and thus continue until all the veins in the body have converged into two large vessels called the

SUPERIOR AND INFERIOR VENA CAVA,

or the vena cava descending and the vena cava ascending. These two great venous trunks both enter the right auricle of the heart, approaching from different directions, and there mingle their contents. The vena cava descending, carries the blood from the head and upper parts of the body, and the food and lymph from the thoracic duct, and the vena cava ascending carries the blood from all the lower parts of the body, together with the food and blood commingled, that have flowed through the liver. (See Fig. 20.)

The blood is thus continually making circuits to every part of the body, and returning to the point from which it started. Leaving the left ventricle, it flows through the arteries, capillaries and veins, back to the heart, entering the right auricle, and through it to the right ventricle, thence through the lungs and back to the heart, entering the left auricle and passing down into the left ventricle, and thus completing the circuit.

As a clear understanding of the

CIRCULATION THROUGH THE LUNGS,

is quite essential to a full appreciation of the work done by the respiratory system, and, for that reason, will be found very important in the next chapter, we will, therefore, explain it a little more fully. The blood in circulating through the lungs, leaves the right ventricle through a large vessel called the

PULMONARY ARTERY.

This artery soon divides into two branches. One of these branches extends to the right lung and the other to the left. (See Fig. 21.) These branches divide and sub-divide in the lungs, until their minute divisions are innumerable, and extend to every part of those organs. These minute branches are the

PULMONARY CAPILLARIES.

They are so very small that it is impossible to see them without the aid of a microscope. Throughout the lungs they lie side by side with little air cells and tubes. (This will be more fully explained in the next chapter.)

The pulmonary capillaries, after having distributed the blood in minute particles throughout every part of the lungs, then unite with each other and form little veins. These little vessels formed by the union of the pulmonary capillaries, are the branches of the

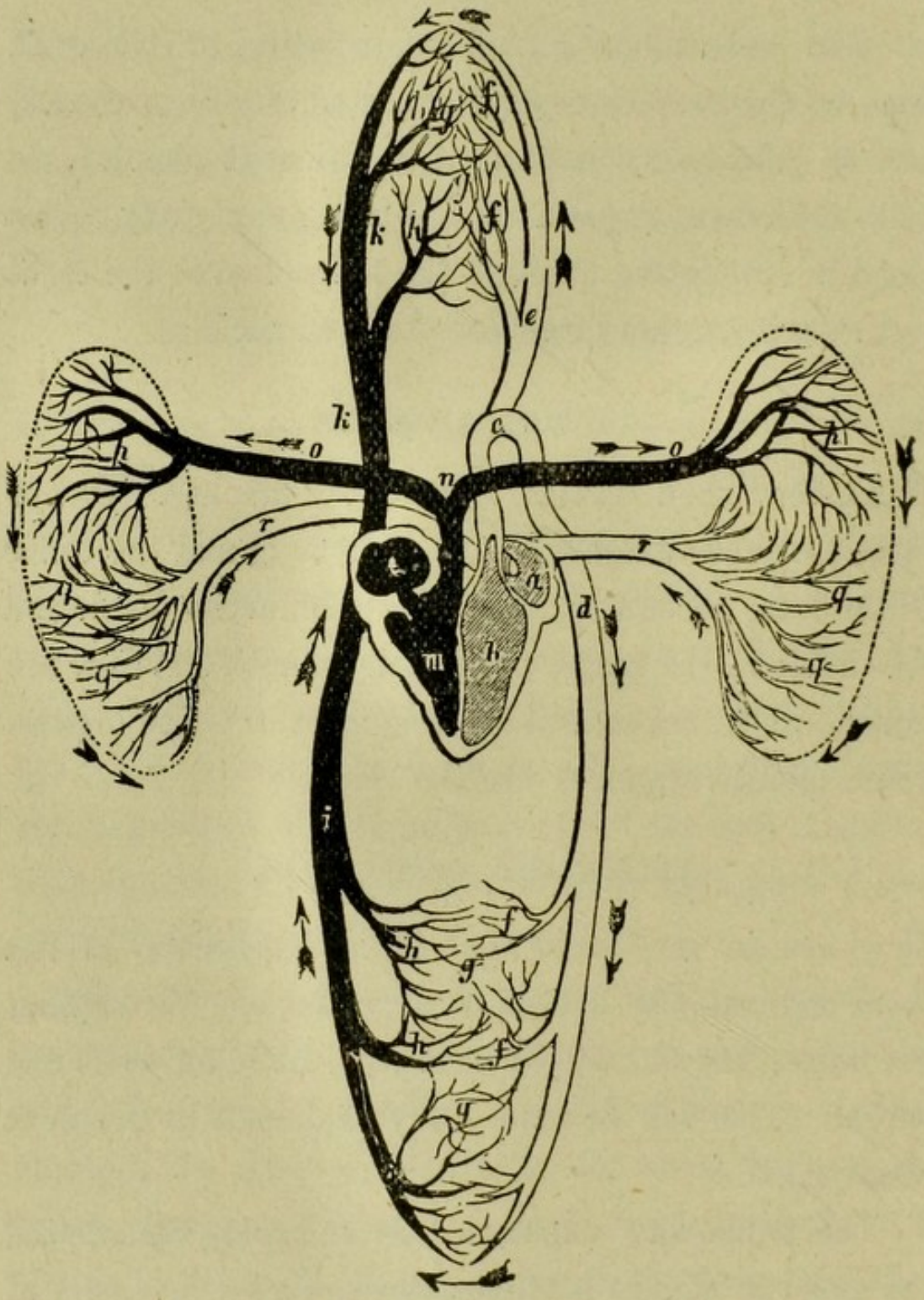

FIG. 21.

Diagram designed to illustrate both the systemic and pulmonary circulation, and also the doubleness of the heart. Upper part of figure indicates the circulation in head, brain, neck, upper limbs and upper part of trunk; lower part of

PULMONARY VEINS.

These little branches unite with each other and form larger veins, which also unite and form still larger. Thus the union of these vessels continues until they all converge in the main trunks of the pulmonary veins. These are usually two in number on each side. But sometimes there are three on the right side, and sometimes only one on the left. The pulmonary veins all open into the left auricle, and there deposit the blood as it comes from the lungs.

GREATER AND LESSER CIRCULATION.

The circulation through the lungs that we have just described, is called the lesser or pulmonic circulation.

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figure indicates the circulation in lower limbs, abdomen with all of its contents, and lower part of trunk; right side indicates circulation of right lung; left side, of left lung. Heavy black lines indicate veins in the systemic circulation, and the lighter lines indicate arteries. In the pulmonic circulation, the heavy black lines indicate the arteries, and the lighter lines, the veins. In both, the lighter lines indicate blood that has received a supply of oxygen, and the darker lines, blood that has given up its oxygen to the tissues, and received therefrom the products of combustion. Light side of heart also indicates oxygenated blood, and dark side, the unoxygenated. The direction that the blood flows, is indicated by the arrows.

Systemic Circulation. — Blood in left auricle, *a*, passes down into left ventricle, *b*, thence through aorta, *c*, large arteries, *d*, *e*, small arteries, *f*, *f*, *f*, *f*, net-work of capillaries too small to be seen only when magnified, *g*, *g*, *g*, *g*, small veins, *h*, *h*, *h*, *h*, larger veins, *i*, *k*, right auricle,

Pulmonic Circulation.—Right auricle, *l*, thence down into right ventricle, *m*, pulmonary artery, *n*, and its branches, *o*, *o*, small pulmonary arteries, *p*, *p*, net-work of capillaries, small veins, *q*, *q*, *q*, *q*, main trunks of pulmonary veins, *r*, *r*, left anricle, *A*.

And that throughout the rest of the body, is called the greater or systemic circulation.

MORE ABOUT THE SYSTEMIC CIRCULATION.

The reader can probably form a mental picture of the systemic circulation, that will be more distinct to his mind's eye, if he will turn to Figs. 19 and 20, and then imagine that he sees both of these figures combined into one, with the arteries and veins lying side by side. And that the smallest of the branches into which the arteries divide, are connected to the smallest of the branches that unite to form the veins. And that the connection between these minute vessels all over the body, is a net-work of capillaries too small to be seen without a microscope, and so close together that the finest needle point cannot pass between them.

DOUBLENESS OF THE HEART.

The heart is really two distinct organs placed side by side, and each one doing its own work. The right side presides over the work of gathering together the blood from all parts of the body, and sending it to the lungs, and the left side gathers the blood from the lungs and assists in sending it to all parts of the body. (See Fig. 21.)

Thus we see that the circulatory system is the part of the mind's machinery that carries heat, force, and building materials, and distributes them to all parts of the machine.

CHAPTER IX.

RESPIRATION.

In the preceding chapters we have examined the process by which the digestive organs take from food, the building materials required for the growth and repair of the body, and the fuel necessary to supply it with heat and force. We have seen how these materials are taken up by the absorbent vessels and commingled with the blood, and how the capillaries distribute them to every nook and corner of the entire body. But all of this work is not sufficient to enable the body to utilize the heat and force contained in the food. Something more is necessary to be done. And that, is the

COMBUSTION OF THE FUEL CARRIED BY THE BLOOD.

This is effected in a way that is quite similar to the burning of fuel in the stoves and furnaces that warm our dwellings, or in the fire-box connected with the boiler of a steam engine. When the fuel taken from the food has been deposited in all parts of the body, the relations between the body and this fuel, are then about the same as the relations between a steam engine and the fuel that has been placed in the furnace beneath the boilers connected therewith, but before the burning

of this fuel has commenced. The heat and force contained in the fuel beneath the engine's boilers, can not be liberated and utilized in operating the engine, until after the combustion of the fuel has commenced. It is just the same in regard to the fuel in all parts of the body, that has been taken from food and deposited there by the capillaries. It, too, must be burned before its heat and force can be liberated and utilized to operate the machinery constituting the body.

NECESSITY OF OXYGEN FOR COMBUSTION WITHIN THE BODY.

Two things are necessary for combustion within the body, as well as for the combustion of fuel in a stove or under any other circumstance. First, the fire must be ignited or kindled. Second, there must be a supply of oxygen.

IGNITING THE FIRES WITHIN THE BODY,

however, is work done by organs belonging to the mental temperament, and this subject will be discussed in the pages treating on that temperament. But supplying the oxygen necessary for the combustion of the fuel deposited throughout the body, is the

ESPECIAL FUNCTION OF THE RESPIRATORY ORGANS,

and we will proceed at once to an investigation of this subject.

We will first examine the requirements of combustion in general, and will then apply the same principles to the combustion that takes place within the tissues of the body.

The stoves that are used in cooking our food and in heating our dwellings, for example, are provided with an opening in front of, or beneath, the fuel that is consumed therein. This opening freely admits the air, which gives up its oxygen to feed the combustion. Perhaps we should explain before proceeding further, that

THE AIR WE BREATHE

is composed of two gases, oxygen and nitrogen. The oxygen is the part of the atmosphere or air that is necessary to our lives, for reasons that we will explain later, and that is also necessary to combustion.

REQUIREMENTS OF ALL COMBUSTION.

The admission of oxygen, however, is not the only requirement of combustion. As fuel is being burned, there are certain gases and unburned parts that are given off in the form of smoke and soot, and these must be carried away. This is accomplished in stoves and furnaces, by the use of chimneys or smoke-stacks. As heated air is not so heavy as cold air, the heated air in stoves and chimneys, has a tendency to rise; and the

smoke and soot commingled therewith, floats out of the chimney and is dissipated in the atmosphere.

The ashes, and the unburnable materials that are placed in a stove together with fuel, must also be separated from the burning fuel in order to permit the oxygen to reach the fuel. This is accomplished in stoves, by placing the fuel on a grate that permits the ashes to fall through as they separate from the fuel, or else the ashes are removed by human effort.

AN INTERESTING EXPERIMENT

that proves the necessity of oxygen in combustion, may be made as follows: Place half a teacup of water in a saucer, then place a piece of burning paper in a teacup, and when it is burning freely, invert the cup with the burning paper upon the saucer of water, and the water will be immediately drawn up into the cup, and the fire will be extinguished as soon as it has exhausted the oxygen in the cup.

WHAT CAUSES THE DRAFT OF A STOVE OR FURNACE.

As the air in a stove or furnace becomes heated by the burning fuel, and it ascends in the chimney or smoke-stack, a vacuum is created, and the cold air, with its supply of oxygen, rushes in. This creates a draft that insures a constant supply of oxygen to the burning fuel. The same principles exactly are ex-

hibited in the burning of oil in a lamp, of the gas that lights our dwellings, and in all other combustion. There are no exceptions.

In the combustion that takes place within our bodies, the same requirements exactly must be met. And they are met very effectually indeed, but through the action of machinery that differs very greatly in the details of its construction. The principles are the same. But the machinery is different.

MILLIONS OF LITTLE FIRES THAT HEAT THE BODY AND SUPPLY IT WITH FORCE.

The force that operates a steam engine, is acquired from the fuel consumed by one large central fire beneath the boiler. The force that operates the mind's machinery, is acquired from the fuel consumed by millions of little fires, that are located in all parts of the body. The oxygen that is necessary to the combustion of the fuel beneath the boiler of an engine, rushes in through the open doors or grates. And the rapidity of the combustion, is regulated by the size of the opening that admits the oxygen. The oxygen that is necessary to the combustion within the body, is commingled with the fuel, and is carried with it to all parts of the body, where it is held in readiness to supply the requirements of combustion whenever the best interests of the body demand that the combustion must take

place. And the rapidity of combustion within the body, is regulated by the amount of oxygen commingled with the blood. And the amount of oxygen that is commingled with the blood, is regulated by the capacity of the machinery that commingles it.

Having explained the general principles of combustion with sufficient fullness for the requirements of this volume, we will now undertake a

DETAILED EXAMINATION OF THE MACHINERY THAT SUPPLIES OXYGEN TO THE BODY.

The machinery that supplies oxygen, however, is the same machinery that conveys out from the body, the equivalents of smoke, soot, ashes, etc., and thus assists to free the body from accumulations that would clog it. There are, therefore,

TWO FUNCTIONS PERFORMED SIMULTANEOUSLY BY THE RESPIRATORY ORGANS.

They convey into the body, the atmosphere, and separate therefrom the oxygen necessary for the combustion of the fuel that has been taken from the food by digestion, and deposited in all parts of the body by the circulatory organs, and they also free the body from the products of combustion.

From the facts explained in the preceding pages, we conclude that the machinery of the mind, like an

engine and its accessories, has its furnace, with draft, chimney or smoke-stack, etc., or their equivalents. And we will add, that when either of these parts fails to do its work properly, the results to the mind's machinery are just as disastrous as would be the results to an engine, if the draft, smoke-stack, or some other part should become incapacitated and unable to do its usual work.

We will now examine the machinery which executes the work that we have just described.

THE NASAL PASSAGES

are the channels through the nose that admit air to the trachea or windpipe. They limit the amount of air that may enter the lungs during a given time, and they modify its temperature; and the little hairs lining the walls of the passages, assist to fan out or obstruct dust that may be in the air, and they help to prepare the air for the requirements of the body.

THE TRACHEA OR WINDPIPE,

is the canal that conveys air into the lungs, from the termination of the nasal passages. It is a round tube about an inch in diameter, and about four or five inches long. Its upper end is in the upper part of the throat, and it extends downward, terminating in two branches called the

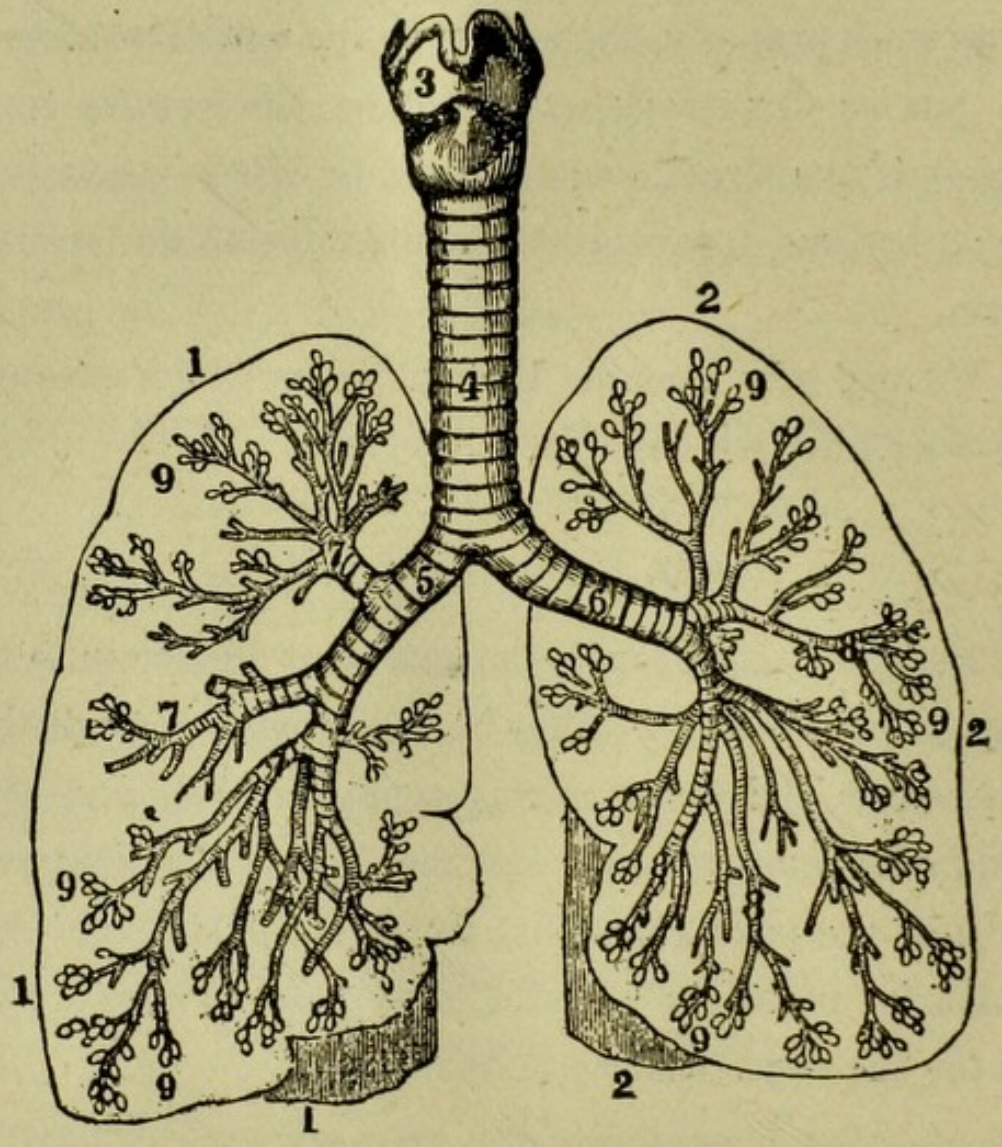

FIG. 22.

Trachea, bronchial tubes and air-cells. 1, 1, 1, an outline of right lung; 2, 2, 2, outline of left lung; 3, larnyx; 4, trachea; 5, right bronchial tube; 6, left bronchial tube; 7, 7, 8, 8, sub-divisions of right and left bronchial tubes; 9, 9, 9, 9, 9, 9, air cells, magnified.

The air-cells, and the sub-divisions of the bronchial tubes that connect with the air-cells, are, of course, only microscopic in size, and they are distributed throughout every part of the lungs, in numbers many times greater than the diagram indicates.

BRONCHIAL TUBES.

Like the limbs, branches and twigs of a tree, these two large branches divide and sub-divide into numberless minute tubes that pass into the lungs and terminate in minute cells. The walls of the trachea and bronchial tubes are composed principally of rings of cartilege and of tissues that hold these rings in position. The rings of cartilege are very elastic, and these tubes are, therefore, always open except when they are compressed. And when a pressure that has closed them, is removed, the elasticity of the tubes causes them to again open.

THE LUNGS

are in the upper third of the trunk, one on each side. The heart is between them, and the diaphram separates them from the abdominal organs. (See Fig. 13.) They are composed of bronchial tubes, cells, veins and arteries, and the tissues that hold these various organs in position and envelope them. They are, therefore, very sponge-like and porous, elastic and light in weight. (See Fig. 23.) It is the lungs that effect an exchange of oxygen from the air to the blood, and that receive from the blood, the products of combustion.

The nasal passages, trachea and bronchial tubes, alternately act as the

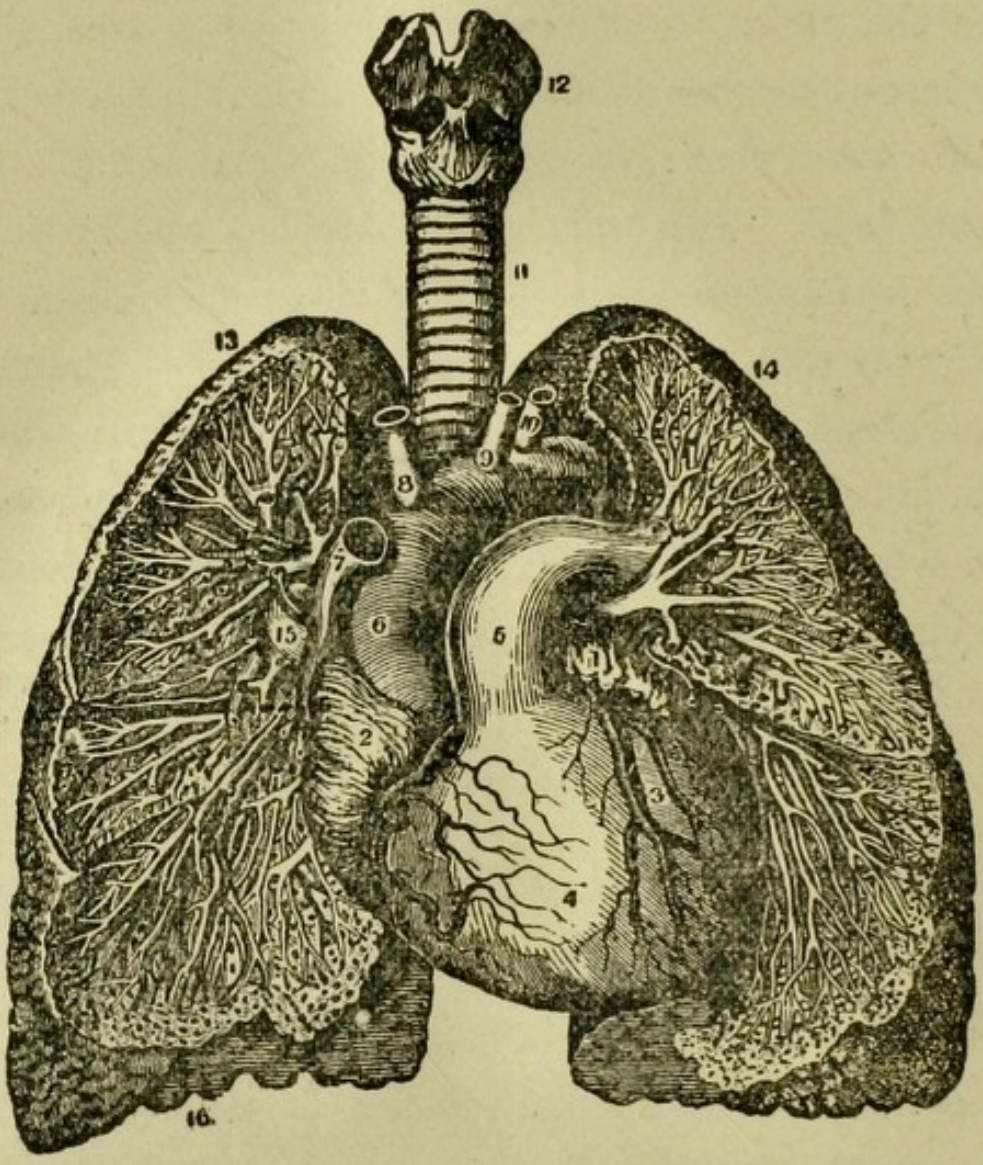

FIG. 23.

Heart, lungs, trachea, blood vessels and bronchial tubes. Each organ is shown in its normal position and proper relation to other parts of the respiratory system. Front surface of lungs is cut away, exhibiting the internal structure of these organs, with the blood vessels and bronchial tubes lying side by side.

1, part of the left auricle of the heart; 2, right auricle; 3, left ventricle; 4, right ventricle; 5, pulmonary artery; 6, arch of aorta; 7, superior vena cava; 8, 9, 10, arteries that carry blood to head, brain and arms; 11, trachea; 12, larynx; 13, upper part of right lung; 14, upper part of left lung; 15, trunk of pulmonary artery.

DRAFT, AND THE GRATE AND CHIMNEY OF THE MIND'S MACHINERY.

When the air is taken into the body, they act as the draft and supply oxygen to the fuel. When it is expelled therefrom, they are the chimney and grate, and they then facilitate the removal of the smoke, soot and ashes.

HOW THE LUNGS DO THEIR WORK.

As we have seen in the chapter on circulation, the arteries that convey blcod into the lungs, divide and subdivide until they constitute a net-work of minute branches. The blood flowing into these branches is separated into myriads of minute particles. The air entering the minute tubes and cells of the air passages, is also divided into numberless minute portions. When thus divided, the minute particles of air, and the minute particles of blood, are separated only by the cell-walls, and these walls are exceedingly thin and delicate. So very delicate, in fact, that the oxygen readily passes through them. And, as there is an affinity or attraction between the blood and oxygen, the latter passes through the cell-walls and enters the blood.

The blood is now provided with all the elements necessary for

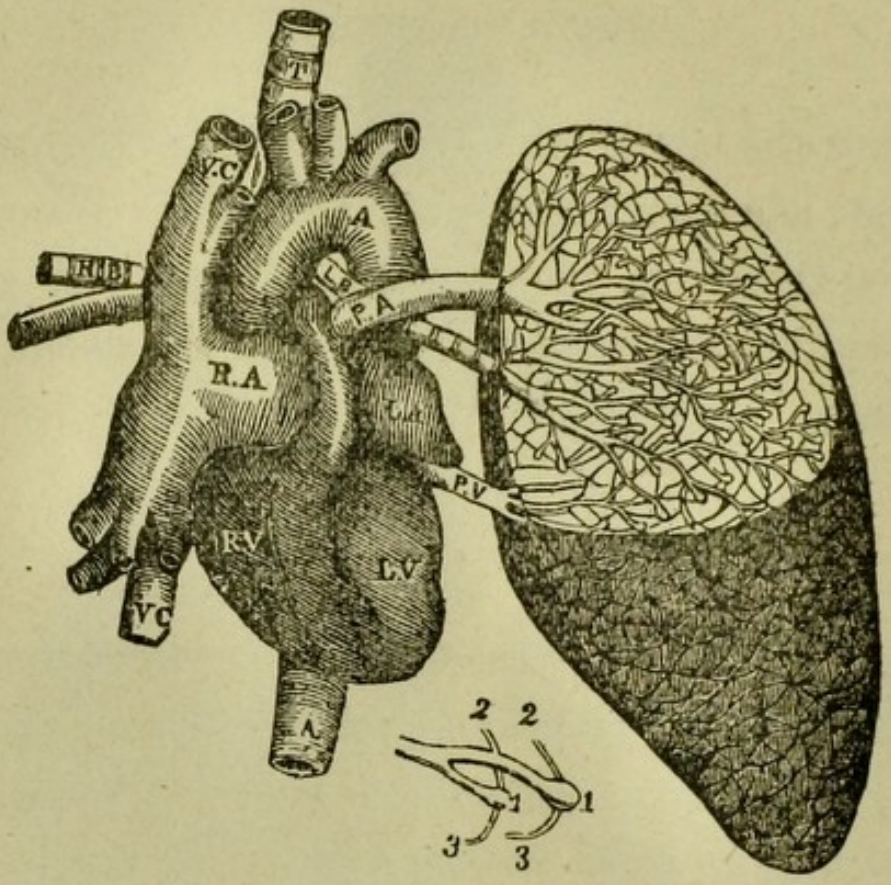

FIG. 24.

Diagram showing the circulation of blood and air in the left lung. The external membranes are removed from upper part of lung, showing its internal structure. *T*, trachea; *L*, *B*, left bronchial tube, the sub-divisions of which terminate in air cells; *P*, *A*, pulmonary artery, the branches and capillaries of which convey the blood to the air cells, to deposit its load of waste materials and receive in exchange a supply of oxygen; *P*, *V*, pulmonary veins, which, with their capillaries and branches, gather together the blood after it is supplied with oxygen, and convey it to the left auricle of the heart. In order to better show the bronchial tube and blood vessels, the diagram represents a wider space between heart and lung, than exists in life. The plan of the circulation in right lung, is, of course, the same as in the left.

In the diagram in lower part of figure, 1, 1, represents magnified air-cells; 2, 2, magnified arterial capillaries; 3, 3, magnified venous capillaries. The capillaries, however, usually extend along with the bronchial tubes, instead of crossing them as shown in the diagram.

COMBUSTION IN THE BODY.

It is loaded with the digested food or fuel, and it contains the oxygen necessary to burn it. Thus provided, it gathers in the pulmonary veins, and they convey it to the heart; and from thence it is sent to all parts of the body, through the arteries and into the capillaries which carry the fuel and oxygen into the fibers of the muscles.

CAUSE OF MUSCULAR CONTRACTIONS.

The nerves acting upon the food and oxygen, cause a combustion that liberates the heat which warms the body, and the force that contracts the muscles. Just exactly how this is done, physiologists have been unable to determine. But there are some things connected with this work, that are known; these we will explain when we investigate the nervous system.

HOW THE LUNGS DISPOSE OF WASTE MATERIALS.

But the work of the circulatory and respiratory systems does not end here. The products of combustion in the muscular fibers, and the worn-out and broken-down tissues from all parts of the body, must be removed to give place for fresh supplies. This debris is gathered up by the capillaries and carried with the blood back to the heart, and thence to the lungs, and is expelled in about the same way as the

oxygen was appropriated. These waste products consist of carbonic acid-gas, moisture and impurities. Throughout the body, the oxygen, fuel and building materials, pass through the walls of the capillaries and enter the tissues needing them, and the waste products pass from the tissues through the capillary walls and into the capillaries, in about the same way as the opposite exchange is effected in the lungs.

VENOUS AND ARTERIAL BLOOD.

As the blood returns to the heart from all parts of the body, loaded with the debris resulting from combustion and tissue waste, it is of a dark color. After it has been freed from these impurities in the lungs, and has appropriated a supply of oxygen, it is then a bright red. The veins, therefore, look dark as we see them through the skin. If we could see the arteries, they would appear red.

WHY THE BREATH ENTERS THE LUNGS.

People speak of drawing the breath, and it really seems that the air enters the lungs because it is drawn in; but the real reason is a very different one. We simply expand the chest and the air rushes in with no further assistance whatever on our part. In the act of

INSPIRATION,

the muscles of the chest draw the forward ends of the

ribs upward, and the diaphram is lowered at the same time. This increases the capacity of the chest and removes pressure from the lungs; and, as the lungs are very elastic, they at once expand. This expansion leaves a vacuum in the little bronchial tubes and air-cells, and the air rushes in to fill this vacuum.

When we consider that there is a pressure of fifteen pounds of air to each square inch of the earth's surface, caused by the weight of the air, and that there is practically no friction in the air's movements, it is very plain that it must rush into every crack and crevice that is not already occupied by air or something else. When we expand the chest and thus permit the lungs to expand by their own elasticity, the air will therefore rush into the lungs by virtue of the pressure caused by its own weight, which forces it in every direction. The act of

EXPIRATION,

is the direct opposite to inspiration. In expelling the air from the lungs, the muscles of the chest draw the forward ends of the ribs downward. This decreases the capacity of the chest. At the same time the diaphram rises and decreases the capacity of the chest still more. This decrease in the capacity of the chest, causes the chest walls to compress the lungs and thus close the little bronchial tubes that permeate every part of them, and this forces out the air that had en-

tered during the act of inspiration. But during the time that the air is in the minute bronchial tubes and cells, it gives up its oxygen to the blood and receives therefrom the products of combustion and tissue waste. The breath as it leaves the lungs, is, therefore, very different from the air when it first enters.

RECAPITULATION.

Now let us recapitulate. The digestive system is that part of the mind's machinery that prepares and furnishes to the blood, the building materials and the fuel necessary to keep the machinery in good repair, and to supply the force required to operate it.

The respiratory system furnishes the oxygen necessary to burn the fuel, and it removes part of the waste materials from the blood, especially the products of the combustion that takes place in the machine.

The circulatory system, is a contrivance for receiving the fuel and building materials from the digestive organs, and for carrying them to the lungs for a supply of oxygen, and for carrying the fuel, oxygen and building materials to all parts of the body as they may be needed, and for transmitting these ingredients to the tissues, and receiving therefrom broken-down and worn-out tissues and the products of combustion, and for carrying these waste materials to the lungs and other organs that cast them out of the body.

CHAPTER X.

DEPURATION.

WASTE MATERIALS THAT WOULD CLOG THE MIND'S MACHINERY.

There is still another class of organs belonging to the vital temperament. These are the organs that cleanse the internal parts of the body by removing therefrom the impurities that are constantly accumulating. The human body, like all other machines, is constantly wearing out, and various parts are breaking down. The waste materials resulting from this wear and the breaking down of its internal parts, must be kept removed to prevent a clogging of the machinery, and to make room for new materials required to repair the machine and to replace the broken down parts.

ADVANTAGES OF CLEANLINESS IN ALL MACHINERY.

A watch, sewing machine or engine cannot be made so as to prevent the different parts from wearing. And the particles of metal that are worn off, together with dust and oil, will clog a machine and interfere with the working of its various parts, unless the waste materials are removed. Even the boiler of an engine, is constant-

ly accumulating waste materials that decrease the value of the boiler and that will eventually destroy its usefulness entirely, if they are not removed.

As it is impossible, or at least impractical, to construct a watch or an engine that will keep itself free from the waste materials that constantly accumulate within its different parts, this waste must be removed by human agency.

SUPERIORITY OF THE MIND'S MACHINERY IN CLEANSING ITSELF.

But the machinery of the mind, is so complete and perfect that it contains within itself, all that is necessary to cleanse every part. And it removes the broken down tissues and waste and useless materials as fast as they accumulate, thus constantly cleansing the body and keeping it free from the debris that would clog its machinery. And the purpose of this chapter is to investigate the machinery by which the internal parts of the body are kept free from the waste materials that would interfere with the operation of all its various parts.

DEPURATIVE SYSTEM.

We have already seen how the liver and lungs remove waste materials from the blood. But these two organs are not sufficient to keep the mind's machinery

thoroughly cleansed of all waste materials that would interfere with the working of it various parts. They require the assistance of the

KIDNEYS

and two other organs. The kidneys are glands, and they do their work in about the same way as all other glands. Large blood vessels carrying blood into the organs, divide and sub-divide into very small branches and thus distribute the blood in minute quantities to the cells of the glands, and the cells remove certain impurities. After the impurities are removed from these small particles, the blood gathers in vessels that converge and form larger vessels, which return the blood to the general circulation freed from such impurities as the kidneys can remove, and the impurities are cast out of the body.

THE SKIN

absorbs oxygen from the air and gives off carbonic acid in much the same way as the lungs do, but in much smaller quantities. It has, therefore, been sometimes called the third lung. But its function of greatest interest to us in this connection, is its assistance in removing waste materials from the body. But it also contains the machinery that keeps the body cool. This machinery is the

PERSPIRATORY GLANDS.

These glands are very small tubes that extend down into the skin and curl up in little balls. They are found in all parts of the body in very large numbers. From the external mouths of these little tubes, a vapor is constantly passing. It is the insensible perspiration. Its constituents are approximately ninety-nine parts water and one part solid matter. An average of about two pounds of perspiration passes out of the body each day.

HOW PERSPIRATION REDUCES THE BODY'S TEMPERATURE.

When the body is freely exercised, and whenever it becomes greatly heated from any cause, the perspiration passes out much more rapidly, and it then gathers in drops on the skin. The evaporation of this moisture cools the body. And the body is cooled slowly or rapidly, in proportion to the quantity of perspiration that is brought to its surface to evaporate. When muscular action liberates too much heat for the body's comfort, the perspiratory glands throw out larger quantities of moisture to evaporate and cool the body, and thus regulate the quantity of heat therein, and keep the body's temperature down to the proper degree.

HOW PERSPIRATION CLEANSES THE BODY.

The solid matter contained in perspiration, is a part of the waste materials of the body. In carrying this waste out of the body, the skin assists in cleansing the mind's machinery, and in keeping it in good working order. Thus, we see, there are

THREE FUNCTIONS SIMULTANEOUSLY PERFORMED BY THE SKIN.

To a limited extent, it carries oxygen into the body, and it removes carbonic acid gas and other impurities therefrom, and it also keeps the temperature of the body down to the proper degree, by bringing to its surface the perspiration.

AUTOMATIC ACTION OF THE SKIN IN COOLING THE BODY.

A point of especial interest in this connection, is the fact that the body's various parts are so nicely related or adjusted to each other, through the laws and principles involved in their activities, that the machinery which regulates the body's temperature, is automatic in its action. When the machinery that heats the body is working most rapidly, the action of the machinery that cools it, is also most rapid. The heat of the body results from the action of its various parts. And this very heat increases the

activity of the perspiratory glands, and a larger quantity of moisture is carried to the body's surface to evaporate, and thus cool the body.

AUTOMATIC ACTION OF THE SKIN IN CLEANSING THE BODY.

It is just the same in regard to the waste materials that are carried out of the body by the perspiration. This waste is the result of the operation of the various parts of the body's machinery. The more rapidly the machinery operates, the greater is the quantity of waste. But this very rapidity in the operation of the body's various parts, increases the quantity of heat liberated therein. And the increased heat, increases the perspiration. As the quantity of perspiration increases, the amount of waste materials carried out by the perspiration, also increases.

Thus, we see, the action of the perspiratory organs is entirely automatic. They work rapidly or slowly in exact proportion to the work that there is for them to do.

AUTOMATIC ORGANS PUT INTO OPERATION BY THE ACTION OF ORGANS THAT THE WILL CONTROLS.

The activities of the voluntary muscles, brain, and most of the physical organs, are under the control of the will, either directly or indirectly. And the action

of the organs that are under the direct control of the will, puts into operation the parts that are automatic and entirely independent of any conscious supervision. This will all appear more plain in the light of subsequent chapters.

THE LARGE INTESTINE

is a continuation of the intestinal canal. It begins at the termination of the small intestine. (See Figs. 10 and 12.) And, like the latter, its walls contain longitudinal and circular muscular fibers, that contract and relax, alternately, and thus force downward the contents of the bowel. As we have before seen, it receives the refuse of the food eaten. Its principal functions are to receive and retain these waste materials, and at a convenient time to expel them from the body. The five organs then that relieve the body of its useless and waste materials, are the liver, lungs, kidneys, skin and large intestine.

IMPORTANCE OF DEPURATION.

The health and vigor of the body require that all of these organs properly perform their natural functions. And if one fails, the other four must do its work in addition to their own, or the life of the body would cease. And if the function of either is suspended for a very long time, death will ensue in spite of the work

done by the others. For example: If the skin is burned from a very large portion of the body, death is always the result. And if the skin is covered with varnish or anything that prevents its action, death soon follows.

RESULTS CAUSED BY A FAILURE OF THE KIDNEYS TO PERFORM THEIR FUNCTIONS.

If the kidneys fail to remove their part of the body's waste, it soon clogs the entire machinery and no part of the body can properly do its work. As the waste accumulates in the body, the mind and all bodily functions become less acute and active, and gradually become more and more sluggish until consciousness is lost, and death gradually ensues.

RESULTS PRODUCED WHEN THE BOWEL FAILS TO PROPERLY DO ITS WORK.

If the bowel fails to carry off its part of the body's waste, all of the faculties become less acute; the skin becomes dirty looking, the breath foul, there is a bad taste in the mouth, headaches ensue, and the work of the entire physical and mental machinery is below par. While the machine is clogged by foul materials, there is not enough room for good.

CHAPTER XI.

CHARACTERISTICS OF THE VITAL TEMPERAMENT PEOPLE.

The character, tendencies and abilities of a person, are influenced and indicated not only by the largeness or smallness of the entire vital temperament as compared with other parts of the body, but also by the size and vigor of each particular organ composing it. This will be more fully explained later.

PHYSICAL FIGURE GIVEN BY THE VITAL TEMPERAMENT.

Persons of the vital temperament are broad, round, plump and fleshy, rather than tall and angular like the motive temperament people, and they are never slender. The chest is broad, and it is deep from the breastbone to the spine. In fact, the entire trunk is broad, deep and long. It is the largeness of the organs within the trunk, as compared with other parts of the body, that distinguishes this temperament. And the trunk must be large to accommodate large organs. The bones in this temperament are small as compared with those of the motive temperament. The joints are consequently

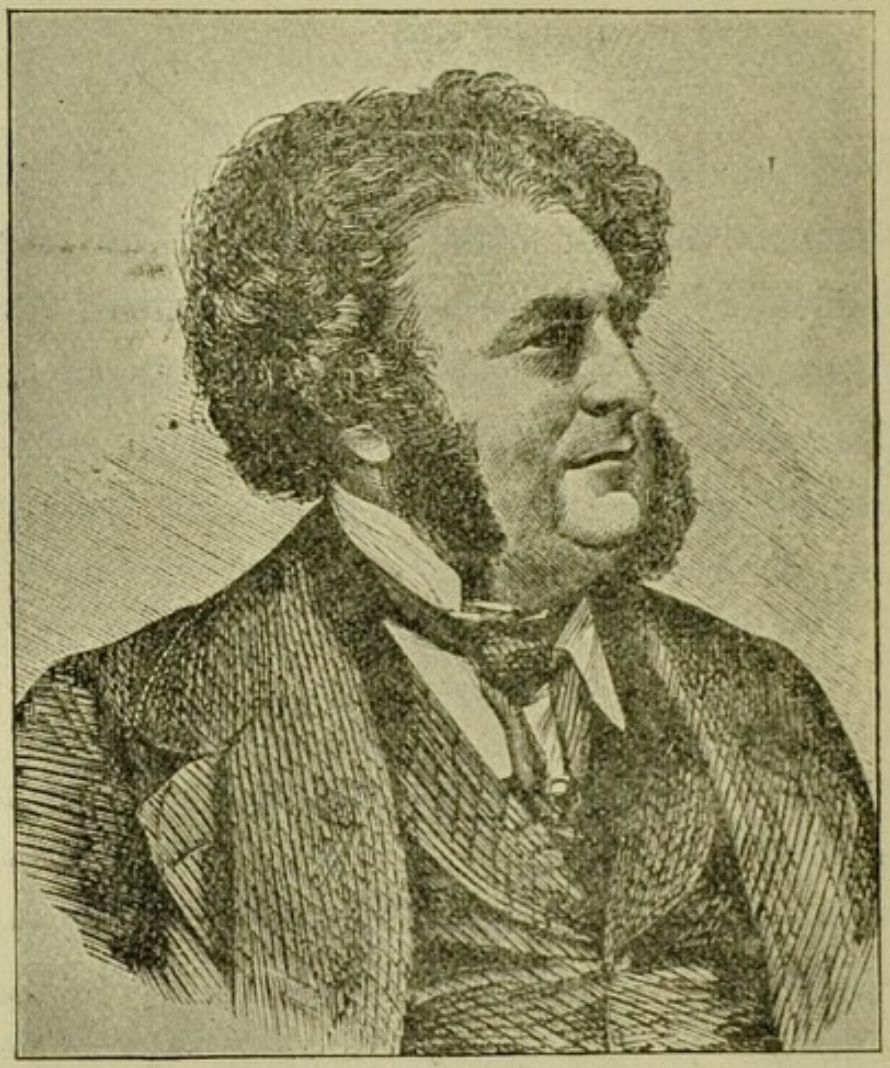

FIG. 25.

MARK LEMON,

Editor of "Punch," London, England. A typical vital temperament.

not prominent, and the *hands* and *feet* are *comparatively small.* A person with the vital temperament, who weighs two hundred pounds, will most likely have hands and feet smaller than a person of the motive temperament, who weighs a hundred and fifty pounds ; because the size of the hands and feet is given principally by the bones, and the bones of the motive temperament are comparatively large, and those of the vital temperament are comparatively small.

THE SIZE AND WEIGHT OF THE VITAL TEMPERAMENT,

is given principally by the large organs within the trunk, and the large amount of flesh that results from a strong, active digestive system. The digestive system furnishes more digested materials than the body can use, and they are stored up in the form of fat. This is especially true of that type in which the abdomen is disproportionately large, showing that the digestive organs are the largest part of the temperament.

THE VITAL TEMPERAMENT AS COMPARED WITH THE MOTIVE,

is distinguished by broadness, plumpness, and smoothness, rather than length, angularity, and prominence. The limbs are plump and well proportioned, and taper to the extremities.

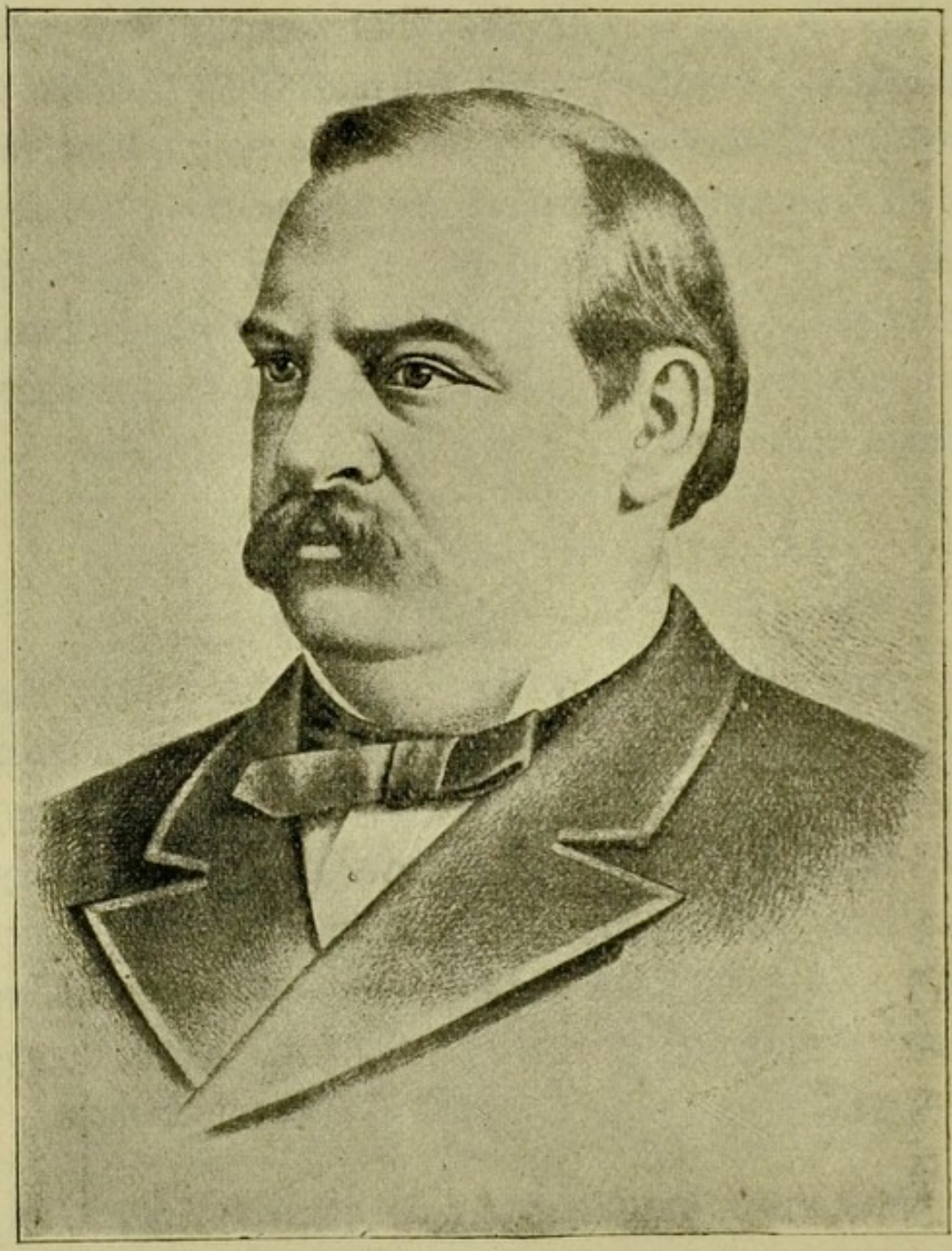

FIG. 26.

GROVER CLEVELAND.

A very large vital temperament, modified by a strong mental temperament and a strong motive temperament. The digestive organs predominate in size, strength and activity, over all other parts.

THE HEAD

is round and broad, and well developed at the base. It exhibits a decided widening from the corners of the eyes to the tips of the ears. The forehead is full and square and broad, rather than high, and the neck is short and thick.

THE FACE IN THE VITAL TEMPERAMENT,

is characterized by the same roundnesss, fullness and smoothness, that distinguish other parts of the body. The nose inclines to the concave rather than the convex type. The pug, rather than the Roman. The nostrils are large. The entire face is round and full, as compared with the oblong type of the motive temperament. The central, fleshy part of the chin, is usually round, full and prominent, but the bony part of the chin is not large. It is persons of the vital temperament that have double chins. The complexion is most frequently light, and is often florid, and the eyes are usually blue. The expression is often mirthful and pleasing.

LET US REASON TOGETHER.

We have already seen that size is a measure of power, and that power is a measure of action. Applying those principles to the subject under discussion,

what must be the character and tendencies of the man or woman of the vital temperament ?

We will state two other principles, both growing out of the former.

The most powerful organs are the *easiest* to exercise.

Every animal inclines to exercise *most*, the organs that it can exercise *easiest.*

Therefore, every animal will exercise its *largest* organs *most*, because they are the *most powerful*, consequently, the *easiest* to exercise. This principle is universal, holding good throughout the entire animal kingdom. Man is no exception.

KEY TO EVERY ANIMAL'S CHARACTER.

It is the key that unlocks the secret of every animal's character. Simply determine which are an animal's largest organs, and learn what are the tendencies given by these organs, and you have an explanation of the controlling characteristics of that animal. This applies to the organs in the brain as well as to the organs of the physical body. To illustrate: The largest organs of

A HOG,

are those included in its digestive system. And the hog inclines to exercise these organs to the exclusion of all others, except as the others conduce to or assist in the

exercise of the digestive organs. When the hog—the modern domestic hog—exercises its other organs, it is only to secure more food for the exercise of its digestive organs. The domestic fat hog spends its life in securing food, eating and lying down, and letting the digestive organs digest it. It is an animal of the vital temperament, and the digestive organs are the largest and strongest parts of the temperament. A man of the same physical build, has the same tendencies.

Another illustration: The largest organs of

A GREYHOUND,

are those included in the motive temperament, and the part of the vital temperament that develops power to operate the motive temperament. Its natural tendency, therefore, is to exercise its motive temperament most. While the hog will eat and lie down and digest what it has eaten, thus exercising its largest organs, the greyhound finds it almost impossible to keep quiet. The power in its motive organs is almost as constantly urging this animal to action, as the hog's digestive organs are urging quiet to the motive temperament, that all of the forces of the hog may be centered in the activities of the digestive organs. A man built like the greyhound, has the same tendencies.

MODIFYING INFLUENCE OF BRAIN.

Of course the entire character of a man can not be just the same as that of a hog or a greyhound, because he has powers that develop a much larger brain than either of those animals, and he will have ambitions, mental powers and tendencies that those animals do not, and these will modify the tendencies given by the physique. But, whatever may be the development of the brain, it can never *entirely change* the tendencies given by the physique. And the man with the temperament of a hog, will *always* have the same *physical tendencies* that distinguish that animal, and *all* others built like him. And the man having the temperament of a greyhound, will *always* have the same physical tendencies that distinguish that animal. And he can avoid the physical tendencies indicated by either of these temperaments, only when he changes the action of his mind. The man of the vital temperament, has a

VITAL TEMPERAMENT MIND;

and that is the reason that he has a vital temperament. The man of the motive temperament, has a motive temperament mind, and that is the reason that his temperament is the motive. And either, to change his temperament, must first change the action of his mind—the builder of his physique.

With these explanations and the principles that we have to work with, let us see what must be the character of the man who has the extreme vital temperament.

LUNGS AND MOTIVE TEMPERAMENT OF GREYHOUND.

But let us first examine into the temperaments of the hog and greyhound a little more fully. While the greyhound has the motive temperament, a part of the organs of its vital temperament are also very strong and influential. Those are the organs that distribute and liberate the power to operate the motive temperament—the circulatory system and the lungs—the organs that carry latent power to the large motive temperament, and the organs that furnish oxygen to liberate this latent power and render it active and accessible for use in operating the large and strong motive temperament machinery. The

CHEST OF THE GREYHOUND,

is very large, indicating large lung capacity and the power that large lungs give. The hog has only moderate lung capacity, and is only moderate in the powers given by the lungs. But even if it had large lungs to generate great power, it could not use it to exhibit the qualities of a greyhound, because it does not possess the comparatively large and strong motive machinery.

Besides, its large digestive system accumulates so much fat, that there is too great a load to carry. The hog, then, is not a perfect example of the vital temperament. But an example of a part of the vital temperament—the digestive system, predominating over all other parts of the body.

But we have, perhaps, said enough to enable the reader to understand that the

CHARACTER OF PERSONS WITH THE VITAL TEMPERAMENT,

must be a combination of the characteristics given by all the organs of this temperament.

Persons of the vital temperament, cannot exhibit the muscular energy characteristic of the motive temperament, because they are deficient in motive power as compared with persons of the motive temperament. They cannot exhibit the aggressive assurance of the motive temperament, because they are instinctively conscious of inferiority in the physical powers that give assurance of physical superiority. And, like the motive temperament, they rely on the powers they have strongest, and they resort to

POLICY, STRATEGY AND DIPLOMACY.

They connot compete with the motive temperament people in the straight-forward, open, aggressive accom-

plishment of purposes by irresistible power, so they endeavor to avoid the power of the motive temperament people, or to direct it in their own favor. They endeavor to convince the motive temperament people, who have the physical power, that their best interests require them to exert this power in favor of the particular vital temperament person who is endeavoring to secure it. Of course a person of another temperament may do the same thing, but it will be studied, and will require an effort, while it is perfectly natural and spontaneous on the part of a vital temperament person. Therefore, when there is lifting to be done, the vital temperament people are especially good at telling somebody else how to do it. They

DISLIKE HARD WORK,

and incline to business, and to directing the work of others. They incline to accomplish their desires in the way that is *easiest* for them. They like to be waited upon, and to have somebody else do the things necessary to their comfort, and they naturally resort to the strategy that secures such favors. Their physical and mental tendencies center in the accumulation and enjoyment of materials within the body. And they will endeavor to secure the assistance of others to further this work. They are accumulating more fuel, building materials and force, within their bodies, than they can

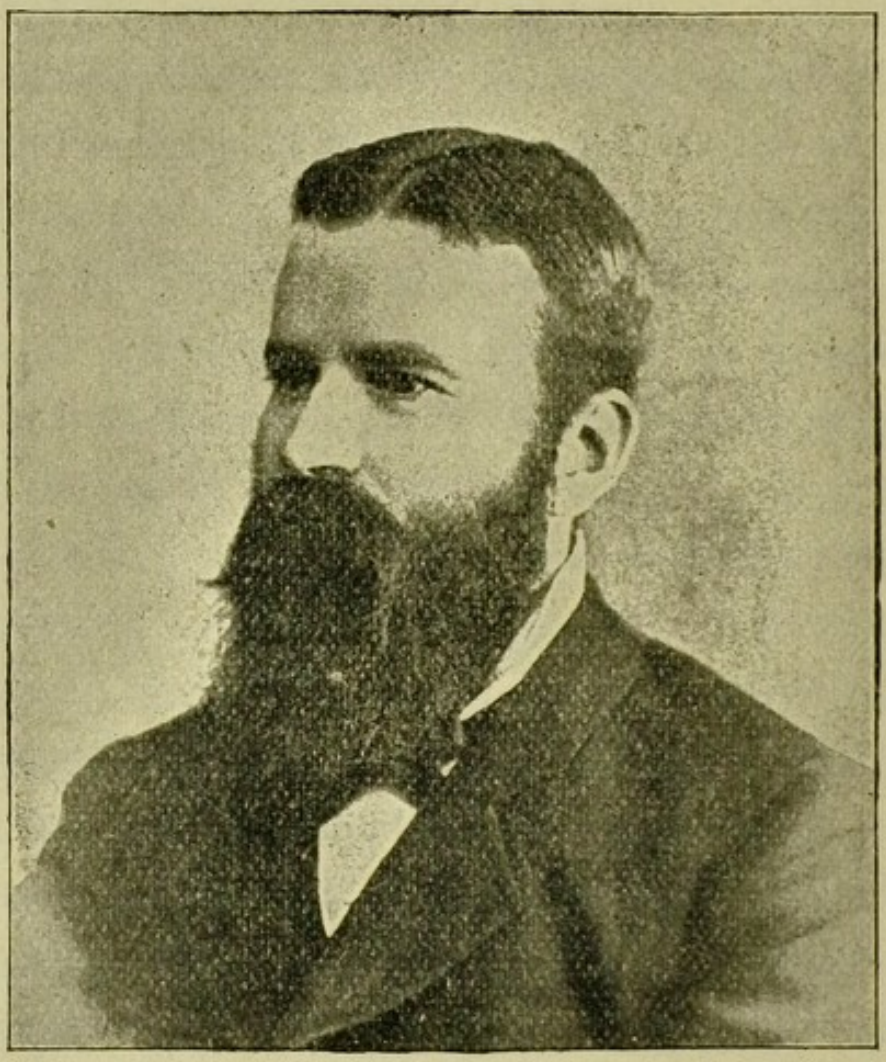

FIG. 27.

HENRY ALLEN,

Traveling freight agent for Nickel Plate R. R. A typical vital temperament.

use. And they will endeavor to secure the co-operation of other people to assist them to secure still more. And they will exhibit the same tendencies regarding the accumulation of money, property, etc. The wherewith to secure still more force, fuel and building materials for the body.

CHARACTERISTICS OF THE VITAL TEMPERAMENT PEOPLE, BRIEFLY TOLD.

The following is an enumeration of their more prominent characteristics, as found in our leading works on character reading. They are very enthusiastic, hearty, impulsive, passionate, impetuous and full of zeal, ardor, shrewdness, secretiveness and diplomacy; they are very fond of physical pleasures, eating, drinking, jovial company, etc.; they greatly enjoy fresh air and moderate out-door exercise, but never hard work; they have ardent feelings, emotions and sentiments; strong appetites and animal passions; they are good livers, fond of meats, condiments, stimulants and animal pleasures; have a strong, steady pulse, great endurance of fatigue, privation and exposure, but not of hard, physical work; have great recuperative powers, and can withstand the physical and mental wear and tear and loss of sleep incident to a hard fought political struggle, but cannot compete with the motive temperament in hard, muscular work; thrive under the

FIG. 28.

EDWARD VII.,

King of England. Vital temperament decidedly predominates. Motive is second in size, strength and activity.

excitement and the exhibition of the strong emotions and passions incident to the life of an actor, but are soon exhausted in walking home over the railroad ties when the company fails and breaks up; are restless and must be doing something, but that something must be easy; have more common sense and judgment of human nature than book learning or scientific attainments; more brilliancy, shrewdness and off-hand talent than depth; more love of pleasure than power of thought; exhibit more mind in business than in literary pursuits; turn everything, and especially bargains, to good account; look out for self, and get a good share of what is to be had; feel and act out, "every man for himself;" are selfish, yet abound in good feeling; will get all they can from you, and repay you in smiles, compliments, courtesies, good nature and affability; it is easy for them to talk; they incline to be agents, overseers, hotel-keepers, butchers, traders, speculators, salesmen, politicians, public officers, aldermen, contractors, etc., but avoid hard, muscular work of all kinds. They do not have the muscular power to compete in hard, physical work, and they are perfectly content to leave it to those who have.

Of course it is only the extreme type of the vital temperament that exhibits all the characteristics we have enumerated, and to the degree described. And only a very small proportion of the persons who have

the vital temperament, belong to the extreme type. In the great majority of persons who have this temperament, while it is stronger than other parts of the body, it is not enough stronger to give all the qualities that we have enumerated, only in a modified degree. And when these qualities are modified and toned down, they give a whole-souled geniality, warmth, ardor, good nature and hearty feeling, that tend to relieve the stern, humdrum, cold and matter-of-fact in life, and to instill sunshine, hope, enthusiasm and good feeling.

Various types of the vital temperament are discussed more fully in subsequent pages.

CHAPTER XII.

MENTAL TEMPERAMENT.

THE BODY'S ELECTRICAL MACHINERY.

This temperament constitutes the electrical machinery of the body;—its telegraph or telephone system, batteries, dynamos, electrical machines, etc. It generates the electrical power necessary to operate its machinery, and it transmits this power to all parts of the body as it may be needed.

This electrical machinery consists of a central station with batteries or dynamos, a switch-board for receiving and transmitting messages, a complicated system of conductors leading from all parts of the body to this switch-board, and others equally numerous leading from the switch-board to all parts of the body. Over these conductors electrical power is sent to all parts of the machinery, and messages are received and transmitted. This machinery constituting the mental temperament, also includes accessory batteries, various electric machines located within the trunk, and innumerable telephones or electric signals located in all parts of the body.

The skull is the main power house, and it covers and protects the principal dynamo and the

CENTRAL STATION OF THE MIND'S TELEPHONE SYSTEM.

The nerves and brain constitute the machinery by which the mind receives communications from all parts of the body, and it is by the brain and nerves that the mind sends its instructions to all parts, and thus controls and directs the working of its machinery.

The brain is the organ with which the mind comes into direct contact and acts upon, and it is through the brain that the mind controls the working of all parts of its machinery. The brain is the switch-board upon which the mind operates, and the nerves are the receiving and transmitting conductors that bring messages from all parts of the body, and over which the mind sends out its commands.

ORGANS THAT KEEP THE MIND INFORMED REGARDING THINGS OUTSIDE OF THE BODY.

The nerves and brain also keep the mind informed regarding external objects and condition. Through the nerves of sight, hearing, smell, taste and feeling, this information is brought to the brain And by the brain, it is classified and made available for the mind's requirements and convenience. (The subjects referred to in this paragraph, will be discussed at length in Vol. II).

The following diagram exhibits a list of the organs constituting the electric apparatus by which the mind controls all parts of the body.

ORGANS COMPOSING THE MENTAL TEMPERAMENT.

- BRAIN,
  - Cerebrum,
  - Cerebellum.
- NERVOUS SYSTEM.
  - Medulla,
  - Spinal Cord,
  - Cranial Nerves,
  - Spinal Nerves,
  - Sympathetic System.

THE BRAIN DESCRIBED.

The brain, with its enveloping membranes, nerves and blood vessels, fills the entire cavity of the skull. It weighs from two to four pounds in the adult, the average being about forty-five to fifty ounces in the male, and a little less in the female. It is quite soft and yielding, being but little more dense than firm jelly or gelatine sauce.

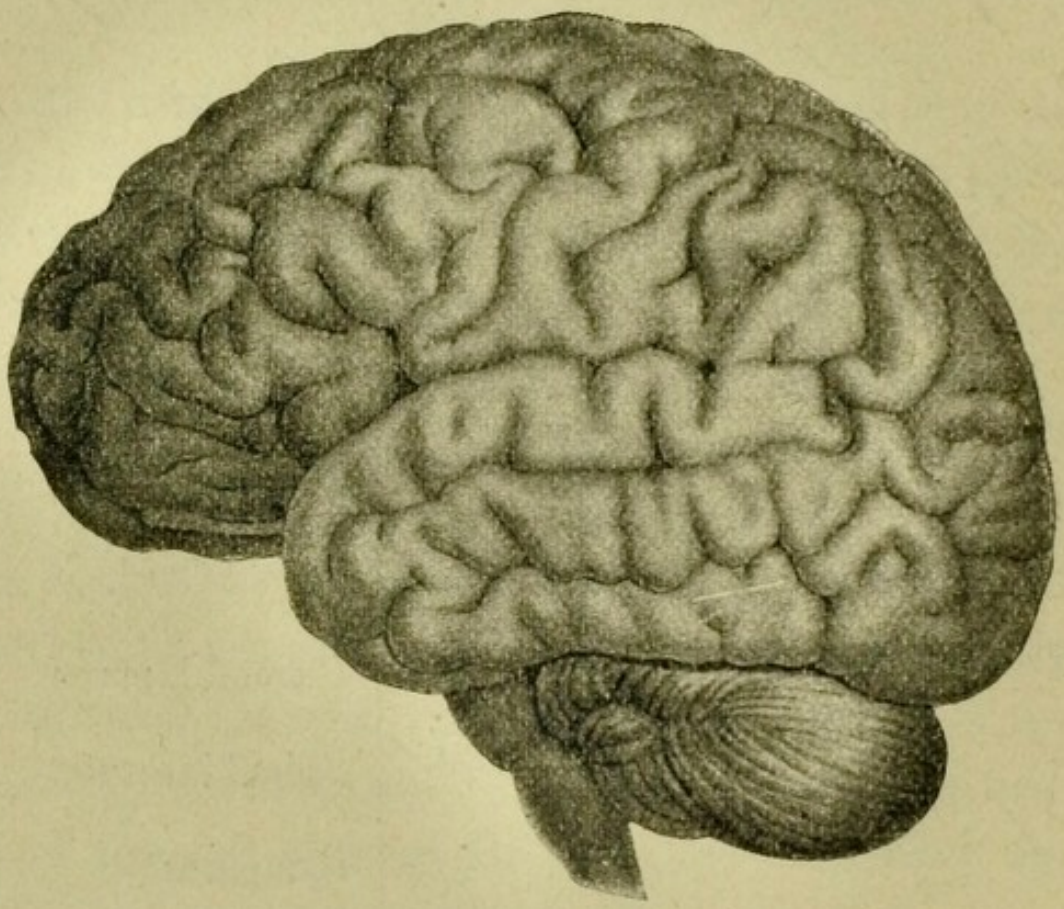

FIG. 29.

HUMAN BRAIN,

as seen from the left side, showing the cerebrum and the corrugated contour of its surface, and the cerebellum with its stratified appearance. The medulla oblongata, extends downward like a stem from the base of the brain.

The brain consists of two parts—the

CEREBRUM, AND THE CEREBELLUM,

or little brain. The former being about seven times as large as the latter. The cerebrum occupies the greater part of the skull, and the cerebellum lies beneath the back part of the cerebrum. The cerebellum is the portion of the brain lowest down in the back part of the head. (See Figs. 29, 31 and 35). On the back of the skull, there is a bony protuberance called the occipital spine. It is more prominent in the motive temperament, but can usually be found on all adult heads. It is located at the point which marks the dividing line between the cerebrum and cerebellum; the former being above this point, and the latter, below. A firm dense membrane separates the greater part of the cerebellum from the cerebrum. But the two brains are connected at the forward part of the cerebellum.

WHAT THE BRAIN LOOKS LIKE.

As the brain conforms to the cavity of the skull, its upper parts and sides, are spherical, and its base is more nearly flat.

The surface of the cerebrum is marked by a large number of depressions or fissures, very irregular in their directions, and causing the brain to present a peculiar folded or wrinkled appearance, that strikingly resembles

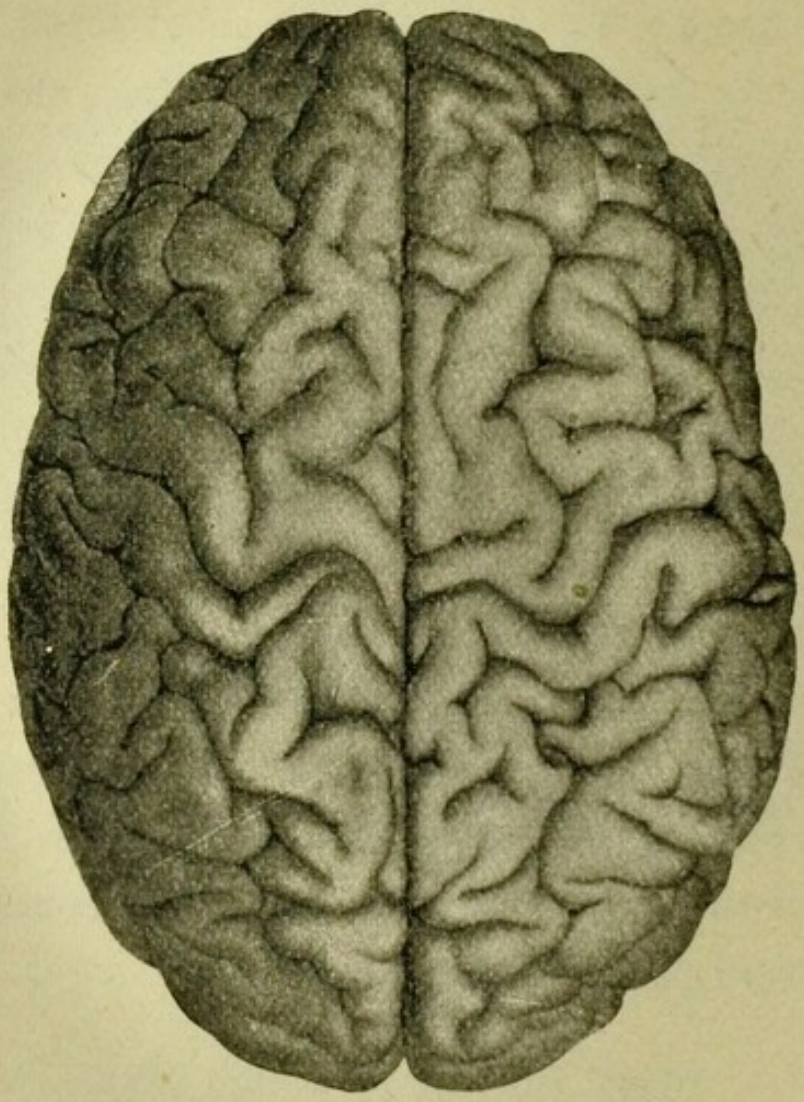

FIG. 30.

THE CEREBRUM,

as seen from above, showing the corrugated contour of its surface, and its division into the right and left hemispheres, by the great longitudinal fissure. Lower part of the figure, represents the posterior part of the brain, and upper part, the forehead.

the surface of an English walnut kernel. (Figs. 29 and 30).

RIGHT AND LEFT HEMISPHERES.

One of these fissures, larger and more deep than the others, is nearly straight, and extends from before, backward, through the entire length of the brain. This appears to divide the brain into a right and left half, as we view it from above; or it appears that there are two brains placed side by side. One of these is called the right hemisphere, and the other, the left. (Fig. 30). But this fissure does not entirely divide the brain. It does not extend to the cerebrum's base. The two hemispheres are connected at their lower parts.

THE BRAIN FURTHER DESCRIBED.

The brain is a very complex machine, and it performs a variety of functions. It consists of a large number of different parts, many of which are pretty well understood, but some of which, are not. It is composed of

CELLS AND FIBERS;

cells for generating nerve force, which is equivalent to electricity, and fibers through which the nervous currents are transmitted. The greater part of the brain cells of the cerebrum, are on its outside, or near the surface, and its fibers are inside and extend to its center.

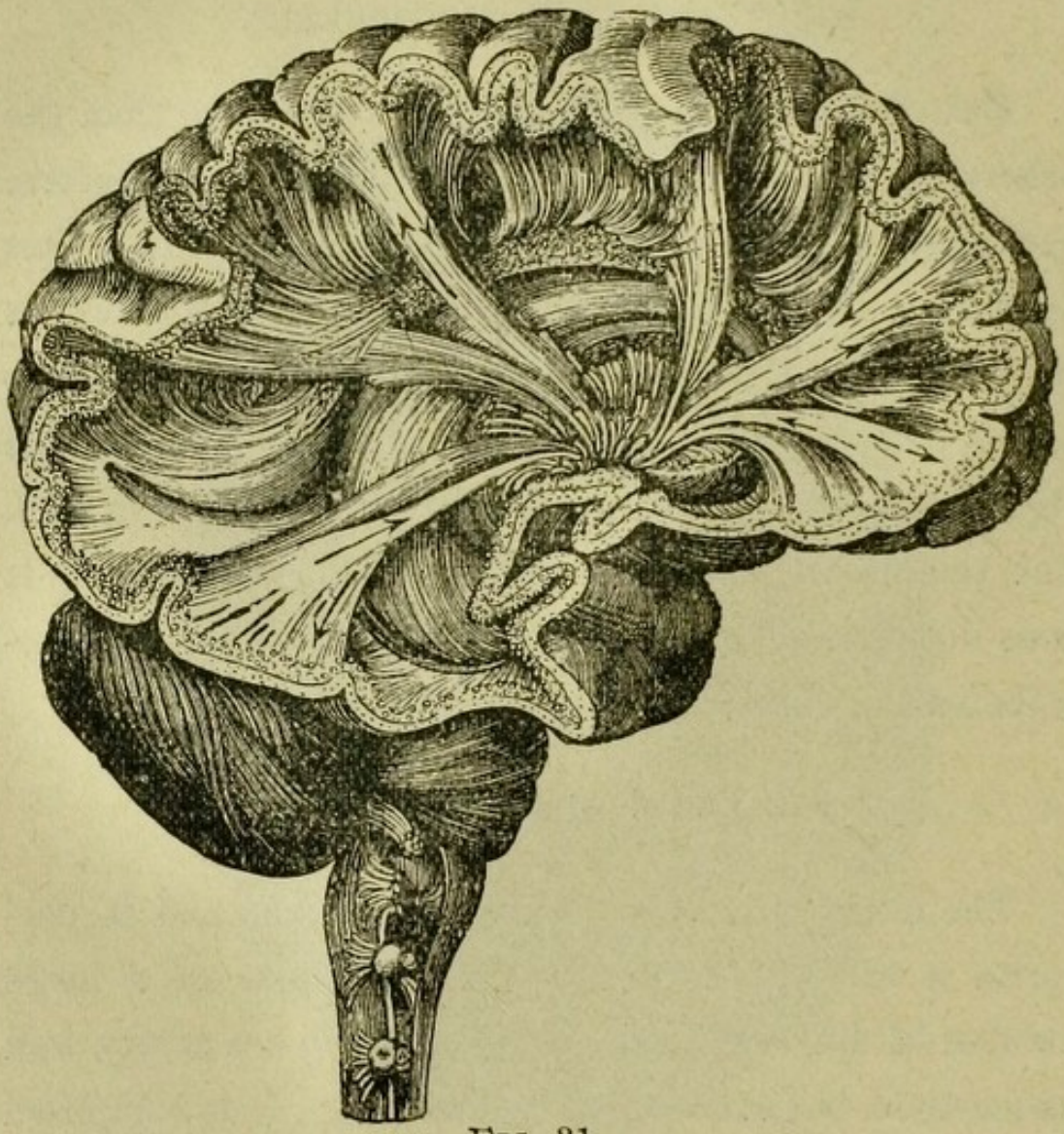

FIG. 31.

BRAIN CELLS AND FIBERS.

The diagram is viewed from the right side, and represents the cerebrum, cerebellum and medulla. The surface of the cerebrum, on the right side, is cut away to exhibit the internal structure of this organ. It may be observed, that most of the cells are near the surface, and the fibers radiate in different directions from the cells, and that many of the fibers converge at a central point in the cerebrum's base.

(See Fig. 31). But there are also some cells deep within the brain. The cells are of a gray, ashen color, and of a pulp-like consistency. The fibers are milk white. The cerebrum is therefore of a grayish color.

CEREBELLUM DESCRIBED.

The cerebellum is almost as large as the fist, and appears to be arranged in parallel layers or ridges which let the gray matter dip down into the white, and when the cerebellum is cut through, there is a mixed white and gray color that gives a peculiar appearance resembling a leaf of the *arbor-vitæ* or tree of life. (Figs. 29, 31, 35.)

CONNECTION OF CELLS AND FIBERS.

The cells and fibers, in all parts of the brain, connect with each other. Each cell has a fiber connecting it with some other cell, or to some other part of the brain. Each cell is thus connected to *all* parts of the body. Some fibers extend from one cell to another on the same side of the brain; some extend from a cell on one side to another cell on the opposite side; and many of them extend towards a central point, from cells in all parts of the brain, and converge near its base, thus forming a large bundle of fibers. (Fig. 31). These fibers pass out of the brain in the form of a large cord or cable that extends from the base of the brain downward. It is called the

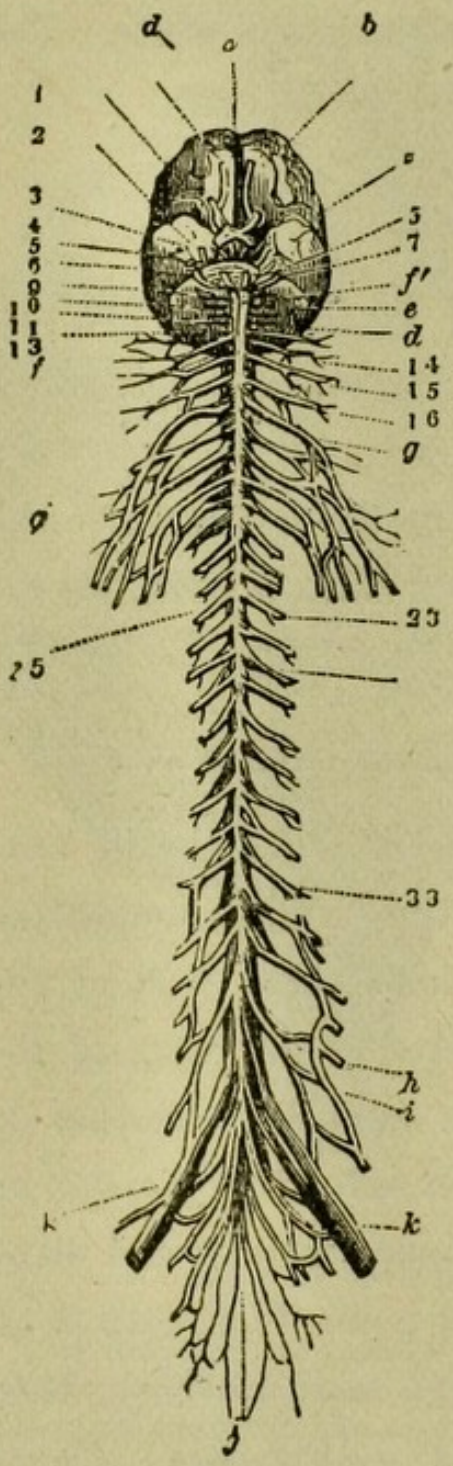

FIG. 32.

BRAIN AND SPINAL CORD,

together with the roots of the cranial and spinal nerves. The view presented, is the base of the brain and the forward side of the spinal cord: *a*, *b*, *c*, *d*, cerebrum; *e*, cerebellum; *f*, medulla oblongata; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, roots of the cranial nerves; 13, 14, 15, 16, roots of first four pairs of spinal nerves; *g*, spinal nerves that extend to the arms; 23, 25, 33, *h*, *i*, *j*, *k*, and all nerve roots between these numbers and letters, are the roots of the nerves that extend to the trunk and lower limbs; *k*, *k*, are the roots of the great sciatic nerves. Fig. 33 shows the spinal canal in which the spinal cord lies.

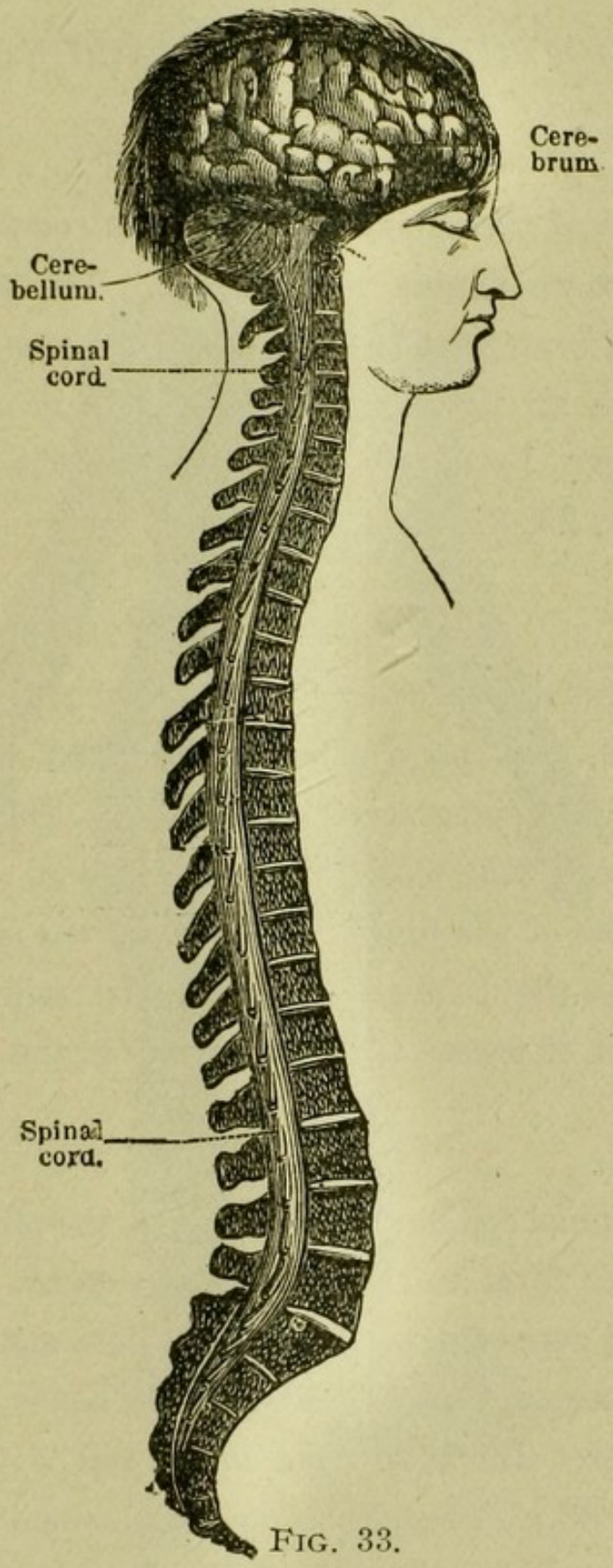

FIG. 33.

SPINAL CORD IN THE SPINAL CANAL.

Right side of spinal column is cut away to show structure of this pillar of bones, with spinal canal extending through it.

MEDULLA OBLONGATA

or capital of the spinal cord, and it is composed of millions of these minute nerve fibers. The medulla connects the brain with the rest of the nervous system, and thus with all parts of the body. It is composed of fibers from both the cerebrum and the cerebellum. (See Figs. 29, 31, 32 and 35.)

THE SPINAL CORD

is a continuation of the medulla. Or, rather, medulla, oblongata, is simply a name for the first two or three inches of the spinal cord. (Fig. 32). This bundle of nerve fibers—the medulla and spinal cord—beginning in the base of the brain, passes down through a large opening in the base of the skull, and still continuing downward, it passes through a canal in the

SPINAL COLUMN.

The spinal column, or backbone, is the pillar of bones that gives form to the neck and central part of the back, and supports the head, shoulders and trunk. It is composed of thirty-three distinct bones, one on top of another. The skull rests on the top of this column. (See Fig. 33.) There is an opening an inch in diameter that passes through each of the bones composing the spinal column. These openings communicate with each other, and with the large opening in the base of the skull.

FIG. 34.

SPINAL NERVES.

Right side exhibits the nerves near the surface. On the left side, more of the tissues, including the surface nerves, are cut away, exhibiting the deeper nerves: 1, Cerebrum; 2, Cerebellum; 3, 3, spinal cord; 4, great sciatic nerve.

and thus form a continuous canal leading from the skull downward through the spine.

SPINAL NERVES.

The spinal cord extends from the brain downward through this canal, and it gives off a pair of nerves at every joint except the last two. There are, therefore, thirty-one pairs of these spinal nerves. They are branches from the spinal cord, and they pass out between the bones of the spinal column, and divide and sub-divide into innumerable branches that extend, either directly or indirectly, to all parts of the body except the front part of the head and neck. (Figs. 34 and 37).

Besides the thirty-one pairs of spinal nerves, there are twelve pairs of

CRANIAL NERVES.

These are nerves given off from the base of the brain, or from the spinal cord before it leaves the skull —the part of the cord called the medulla. Their roots originate in the base of the brain or in the medulla, and they pass out of the skull through small openings in various parts of its base. They divide and sub-divide into innumerable minute branches that are distributed to the nose, eyes, ears, tongue, throat and face. (Figs. 35 and 36.) And one pair extends down into the chest and abdomen.

ARRANGEMENT OF NERVES IN PAIRS.

The nerves all have their origin in pairs. Of each pair, one nerve extends to the right, and the other to the left. One of the optic nerves leads to the right

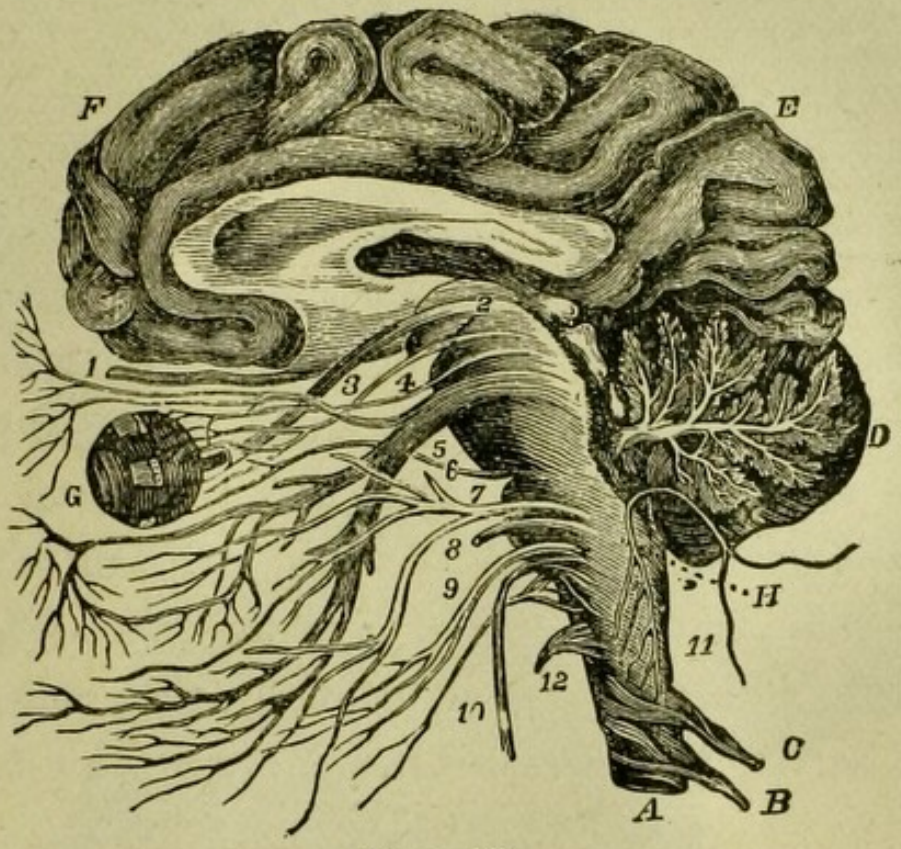

FIG. 35.

CRANIAL NERVES.

A, upper part of spinal cord; *C*, *B*, first two spinal nerves of the left side; *D*, right half of cerebellum, showing the arbor-vitæ; *E*, *F*, right half of cerebrum; *G*, the left eye; *H*, medulla oblongata; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, left cranial nerves

eye, and the other to the left. One of the auditory nerves leads to the right ear, and the other to the left ear. One of the facial nerves leads to the right side of the face, and the other to the left side. The nerves

all divide into branches so small that they cannot be seen by the naked eye. And these minute branches meet and interlace when they approach the same point from different directions. The minute branches of the two facial nerves, for example, interlace and lie side by side at the center of the face, but they do not pass far beyond the center. (Figs. 35 and 36.)

The sixty-two spinal nerves also branch out in pairs. One branches from the right side of the spinal cord, and the other from a point just opposite on the left side, and they extend in opposite directions. The branches distributed to the walls of the trunk, meet and intermingle at its center in the front part of the body. Of the pairs sent to the limbs, one from each pair extends to the right limb, and the other in the left. (Fig. 34 and 37.) Either directly or indirectly, the cranial and spinal nerves, together, penetrate every point in the body.

MOTOR AND SENSORY NERVES.

There are two kinds of nerves—the motor and sensory. The former are the nerves of motion, the latter, of feeling. The former carry commands *from* the brain. The latter convey sensations *to* the brain. Example: Something hurts the foot. The nerves of sensation inform the brain, and the brain sends an impulse through the nerves of motion, and this acts upon the muscles in the limb, and the foot is removed to prevent further

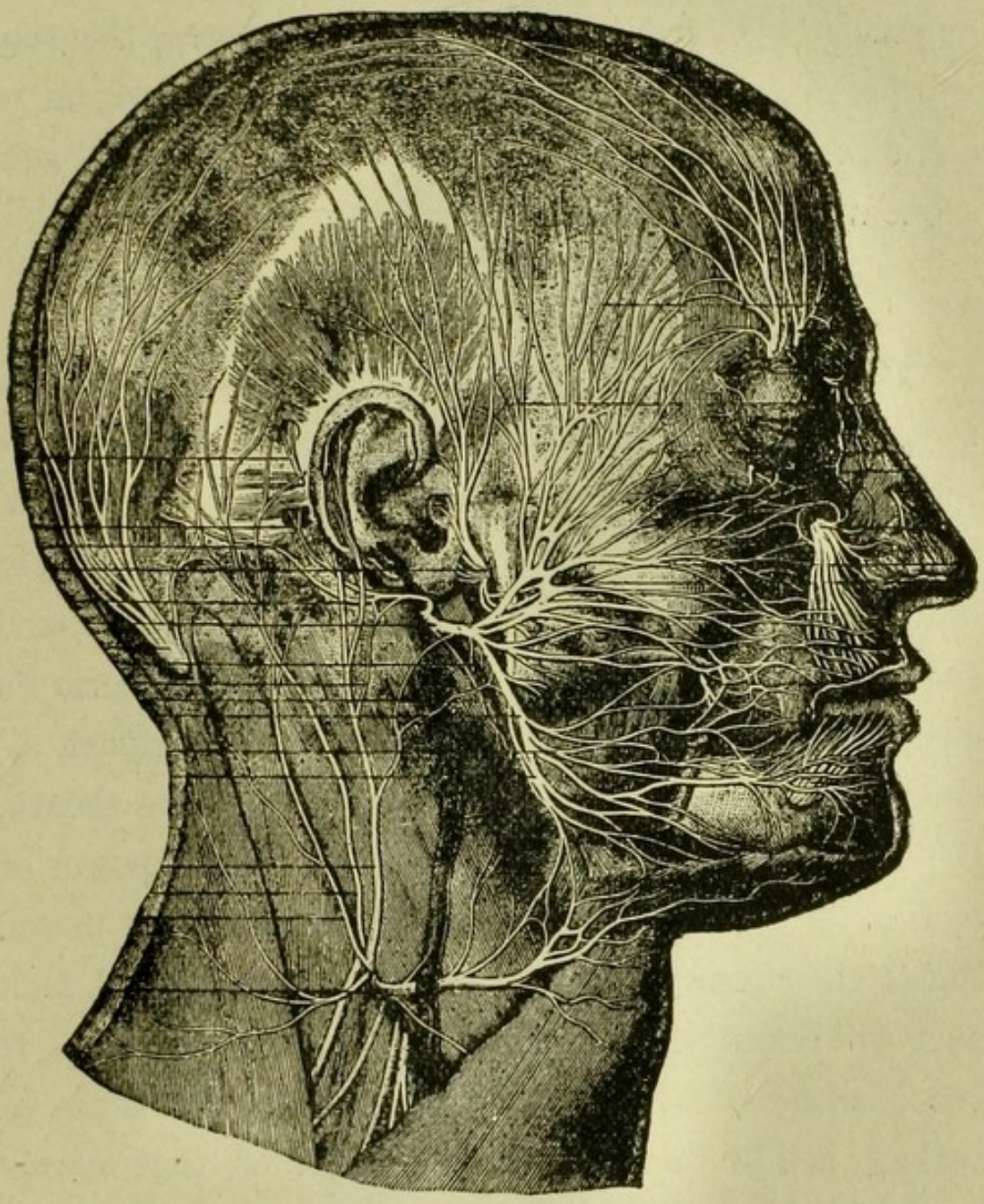

FIG. 36.

SUPERFICIAL NERVES

of the right side of the head, face and neck. The nerve passing out beneath the ear, is the facial nerve. It is one of the twelve cranial nerves. Those distributing over the neck and the back part of the head, are spinal nerves. The terminal sub-divisions of these nerves, being microscopic in size, no attempt is made to show them.

injury. And all is done in much less time than we can explain it. But if the injury is very severe, the foot will be removed still more quickly, and independent of any direct action of the brain, as will be explained subsequently.

THE NERVE ROOTS.

Each one of the spinal nerves arises from two roots—an anterior and a posterior root. The former is the motor part, and the posterior, is the sensory part. These two roots soon unite and form one nerve trunk; but the two classes of nerve fibers remain distinct, and each continues through its entire length to perform its own distinct function independent of the other part, although the two parts are bound together in one sheath. If the motor root of a nerve is severed, the power of motion is lost in all parts depending on that nerve. But if the sensory part of the nerve is uninjured, that part will continue to perform its proper functions. If the sensory root of a nerve is severed, the sense of feeling is lost in all parts dependent on that nerve.

There is another very important class of nerves called the

SYMPATHETIC SYSTEM.

This consists of a double chain of nerves located in the back part of the trunk, just in front of the spinal column, and extending from the head to the lower part

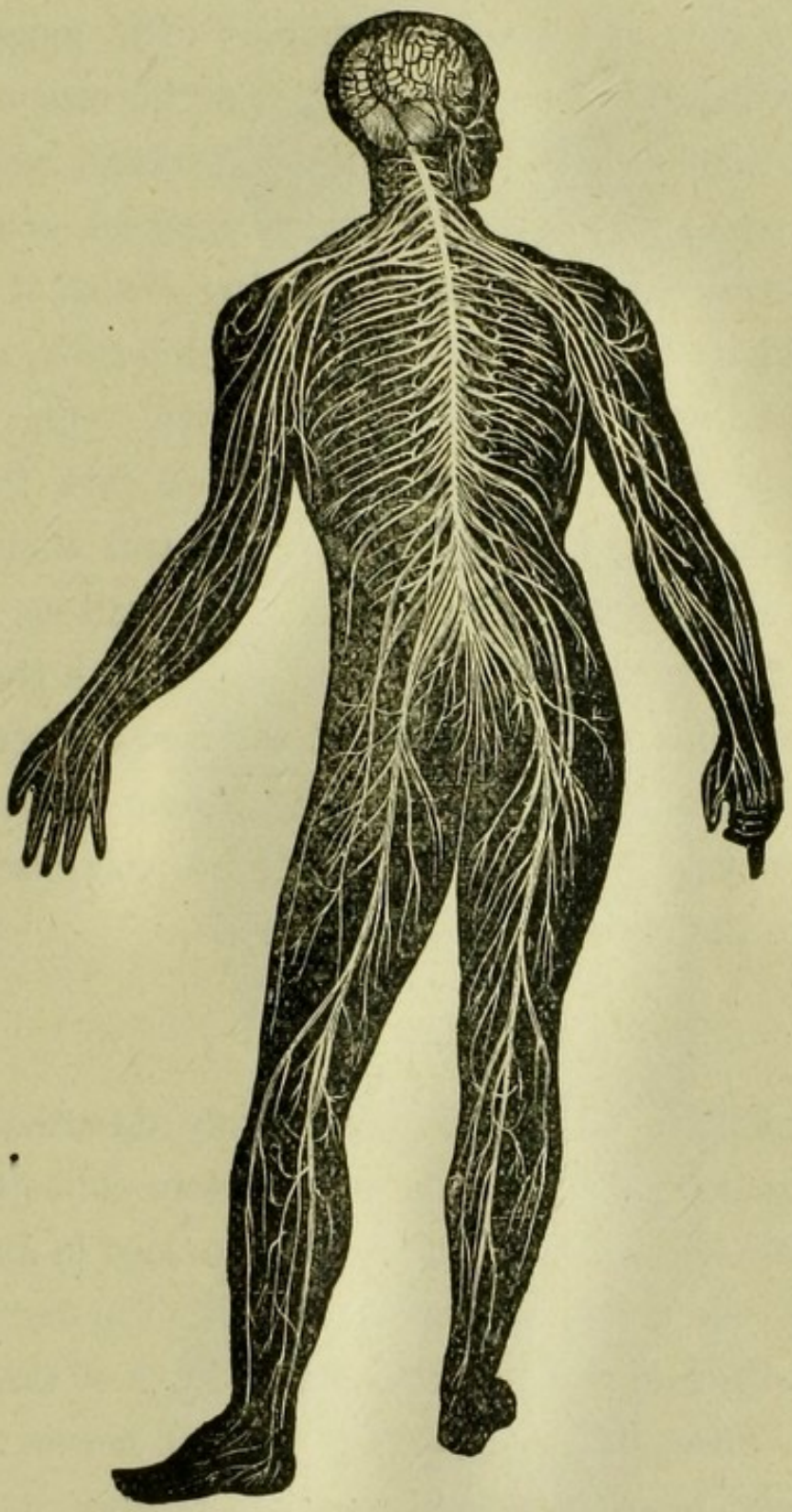

FIG. 37.

DIAGRAM OF SPINAL NERVES.

Cerebrum and cerebellum are also shown, the back part of skull being removed.

of the spine; and also, of numerous little ganglia, or knots or masses of nerve matter, from the size of a pin-head to that of a pea or hazel-nut, through which the nerves pass; and also of numerous branches connected with the nerves just mentioned:—two chains of nerves and ganglia on each side of the spinal column, and the nerves and branches connected therewith. (Fig. 38.)

This system is intimately connected with the vital organs, and seems to regulate and control their functions. Its branches extend to all of the various organs within the trunk, and they also connect with the brain and the spinal nerves. Most of the nerves distributed to all of the *in*voluntary muscles, belong to the sympathetic system. Those distributed to voluntary muscles, are the cranial and spinal nerves.

PLEXUS.

In addition to the nerves already described, the sympathetic system also includes certain collections or aggregations of nerves and ganglia located in different parts of the trunk, and connected with the nerves and ganglia lying in front of the spine. Each of these collections forms a plexus or net-work of nerves that is intimately related to some part of the work of digestion, circulation, respiration or depuration, and to the organs by which these functions are performed. One of the most important of these, is the

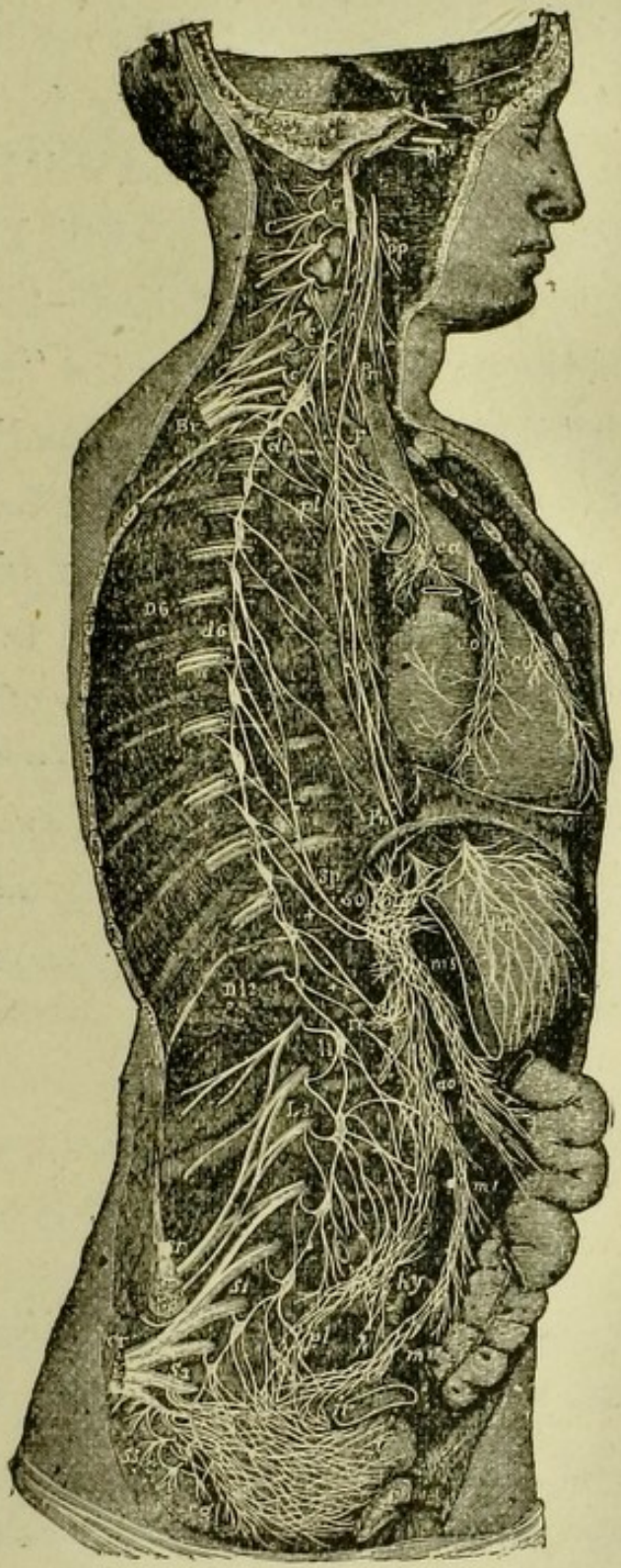

FIG. 38.

SYMPATHETIC NERVES.

SOLAR PLEXUS,

located just below the stomach. The result of a heavy blow upon this region, in paralyzing for a time, the action of the internal organs, is too well known to require an extended explanation. We will, however, call attention to its effect upon respiration—the temporary suspension of the power to breathe—the "knocking out of the breath," that most boys have experienced. We mention this to call attention to the effect upon distant organs, caused by a blow in this region, showing how intimately these organs are related to each other, and how all the organs in this region, are effected by an injury to one part of the sympathetic system. Other functions are also paralyzed as well as that of breathing, but breathing being a function that must continue almost constantly, its temporary suspension is more noticeable.

Let us take

A BRIEF REVIEW.

The brain is the central station of the mind's telephone system. The nerves are the telephone wires. The spinal cord is a great cable or bundle of these wires that are bound together for convenience, like the bundles or cables of telephone wires that may be seen in the down-town sections of a city.

The cables of a city's telephone wires, extend along bound together, until a point is reached in a distant part of the city, where it is desirable that they lead direct to individual telephones. At that point, they separate, and each extends to its own particular destination. We have the same plan exactly in the spinal cord and its branches.

NERVOUS SYSTEM EXCEEDINGLY COMPLICATED.

But the nervous system of the body, is much more complicated than a telephone system. There are millions of little nerves—the branches from the large nerves. Part of these little nerves act as telephones or electric signals that keep the brain constantly informed regarding the state of the body. It is impossible to prick any part of the body, with a needle, ever so fine, without producing a sensation of pain. And the reason that pain is felt, is because a minute nerve branch is injured. If the body is hot or cold, or there is a pain in some part, or if it is entirely comfortable, or whatever its condition may be, the mind is kept constantly informed by the minute nerves sending the proper information to the brain.

When we consider how small the point of a fine needle is, and that the nerves are so close together that the needle point cannot pass between them, we begin to realize what an immense number of nerves there must be.

And when we consider that they are too small to be seen without the aid of a microscope, and that most of these minute fibers leads direct to the brain, we realize still more fully, how very delicate and complicated and extensive the nervous system is.

And besides this immense number of sensory nerves, there are innumerable nerves that carry motor impulses from the brain and cause motions in various parts of the body.

REFLEX ACTION OF SPINAL CORD—ITS AUTOMATIC MACHINERY.

There is one other very important function of the spinal cord that deserves an explanation in this connection, and that is what is called its *reflex* action. It is a work that it does without the conscious supervision of the mind. Example: A man steps on a tack that penetrates his foot. The pain is felt and the foot is lifted before the brain has had time to receive the impression of pain, and before the mind has had time to act. The foot is raised by a sort of instinctive impulse, and the mind has not reasoned on the matter at all.

In this work, then, the spinal cord is an automatic machine which is so arranged that it will work independent of a conscious effort of the mind. It is so adjusted that the irritation or injury of minute termi-

nal nerves, conveys such an impulse to its machinery, that it is set in motion and immediately acts upon the machinery that removes the member that is being injured, and that might be injured still more if not removed.

This reflex action of the spinal cord, including the medulla, extends not only to the feet, but also to the hands and other parts of the voluntary muscular machinery, and also to the vital organs. We walk, stand, wink the eye, digest our food, breathe, circulate the blood, etc., without any conscious effort of the mind. And it is the automatic machinery of the spinal cord and medulla that makes this possible.

IMPORTANCE OF THE MIND'S AUTOMATIC MACHINERY.

The importance of the work done by this automatic machinery in the nerve centers, is beyond computation. By this machinery being so set or adjusted that it will promptly act at the proper moment, the mind is left free to be occupied in other matters. Otherwise the mind would be almost constantly engaged in overseeing the work that is now done by its automatic machinery.

Indeed, if it was not for this reflex action, it would keep us busy to keep alive. And we would not have time to think about anything else but breathing, digesting, keeping the blood in circulation, etc.

CHAPTER XIII.

SIMILARITY OF NERVE FORCE TO ELECTRICITY, AND THE NERVOUS MACHINERY TO ELECTRICAL MACHINERY.

In the preceeding pages we have referred to

THE BRAIN AS A DYNAMO

or a battery, and will now explain more fully what we mean.

The brain and nervous system cannot do their work without power. They require the action of energy just the same as an engine or a telephone. And it is the brain that supplies the most of this energy—the nerve force. As nerve power resembles electricity more than any other force known to man, it will facilitate our studies in this form of energy, and the method of generating it, to compare it with electricity, and the manner of generating that power.

We have seen that the sun is the source of all energy. And that a steam engine with its furnace, boiler, etc., is a contrivance for taking from fuel, the sunlight that has been condensed therein, and transferring it to water, thus converting the water into steam that may

be applied to the engine, and set it in motion. In other words, that a steam engine is a contrivance for converting latent energy into motion.

We have also seen, that in this respect, the human body is practically the same thing—that it takes latent force from food and converts it into motion—into physical movements of various kinds.

AN ELECTRIC DYNAMO.

If the force or motion from a steam engine is transferred to an electric dynamo, the result is electricity—another form of power or motion.

An electric dynamo, then, is a machine for converting energy, or motion, into another form of force that we call electricity.

AN ELECTRIC BATTERY

is a contrivance for transferring force from metals to the conductors of the battery. A simple form of galvanic cell, consists of a jar partly filled with dilute acid, into which two metallic plates are submerged. The most usual plates are copper and zinc, and they are placed a short distance apart. The acid slowly disintegrates these plates, and thus liberates latent force. But it dissolves one of them more rapidly than the other. This causes a current of liberated force—electricity—to flow from one of the plates, through the

fluid to the other plate. The electricity is liberated more rapidly, from the plate that more rapidly disintegrates, and the force thus liberated, flows through the fluid to the plate that dissolves more slowly. If the two plates are connected, outside of the jar, by a copper wire or any other good conductor, a continuous current

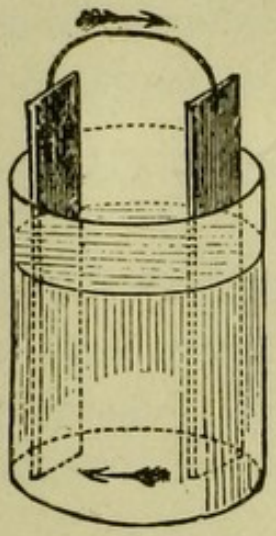

FIG. 39.

GALVANIC CELL.

Direction of the current, is indicated by the arrows.

of force will flow through the circuit thus formed. The length of the outside conductor may be only a few inches, or it may be many yards.

A galvanic battery consists of a number of these cells coupled together; the strength of the battery depending upon the size and number of the cells.

This is the method of generating the force that operates telephone and telegraph systems.

RELAYS.

But it has been found impractical to use batteries strong enough to generate all the power necessary to send a message a very long distance. It has been found more expedient to use accessory batteries or relays at various points along the line, to add more electricity and thus re-enforce the original current.

NERVE GANGLIA.

In the human body we find practically the same thing. The various nerve ganglia are the relays that re-enforce the currents generated by the brain. Just

HOW THE BRAIN GENERATES NERVE FORCE,

is not positively known. But there is no question but that it does generate it. Nor any question about the cells being the parts that do this work, and the fibers being the parts that conduct the currents. The cells of the brain, then, correspond with the cells of a battery. And the fibers of the brain correspond with the conducting wires that connect the plates of a galvanic cell, and those that connect one cell with another, or with a large number, and the nerves correspond with the telephone wires that connect distant parts of a city.

SOURCE OF NERVE POWER.

The blood supplies the force from which the brain cells generate nerve power. That a large amount of blood is necessary for this purpose, is evidenced by the fact that one-fifth of all the blood of the body, is sent to the head, and most of it reaches the brain. The head is hardly one-twentieth part of the entire body. And the brain is only about one-fiftieth of the weight of the entire body. So it is very evident that the work done by the brain is a very important one.

A PART OF THE BRAIN'S WORK THAT IS STILL A MYSTERY.

The cells of the brain, in some way that is still a mystery, take from the ingredients of the blood, the necessary force, and raise it to a higher form of force that is called nerve force, or nerve fluid. Or else the nerve fluid exists in the blood just as it afterwards exists in the nerve tissues, and instead of the nerve cells raising it to nerve force, from some lower form of force, the cells simply gather it together from the blood, and store it in the nervous system. But just exactly how this work is done, as before stated, is still a mystery.

WORK OF THE BRAIN AND NERVES THAT IS MORE DEFINITELY UNDERSTOOD.

But whatever may be the details that are involved in the accumulation of the nerve force in the brain, there is no question in our mind regarding the fact that it is generated by the brain, and that it resembles electricity more nearly than any other force known, and that the machinery which generatesit, more nearly resembles electrical machinery, than any other machinery now in use.

And there is no question about the mind using the nerve force and the nervous system, in the capacity of a telepraph or telephone system, and communicating instantly with all parts of the body.

The nerve fluid is also sent over or through the nerves, to the various muscles, glands, etc., where it is utilized to put these organs into operation.

The brain, then, is the central dynamo or battery that furnishes most of the nerve force that operates all of the machinery of the nervous system. But it is re-enforced by a large number of little batteries—the ganglia—located in various parts of the body. An examination of the functions performed by the

PNEUMOGASTRIC NERVE,

will assist us to a better understanding of this part of the brain's work. The pneumogastric is one of the cranial nerves; and it is one of the largest and most

important. It is given off by the medulla and passes out of the skull through an opening in its base, and extends down through the neck into the chest and abdomen. There is, of course, one on each side. (Fig. 40.)

This nerve extends to the lungs, stomach and heart, and it presides over the functions of all these organs. There are also other nerves that lead to the same organs, but it is the pneumogastric that affords a *direct* communication between them and the brain.

SIMILARITY OF NERVE FORCE AND ELECTRICITY, PROVED BY EXPERIMENTS ON ANIMALS.

The similarity of nerve force and electricity is shown by the following experiment. A physiologist has taken a number of small animals—rabbits or guinea pigs—and after feeding them on cabbage, lettuce leaves or some other appropriate food, he has killed them at different intervals and examined their stomachs to see how much the food had been digested. One was killed, perhaps, at the end of an hour, another at the end of two hours, another at three, another at three and one-half, etc., and the stomach of each animal, examined. He thus learned how much of the digestive process had been accomplished in a given time.

Other similar animals were then taken and fed in the same way, and after they had filled their stomachs, their pneumogastric nerves on both sides were immedi-

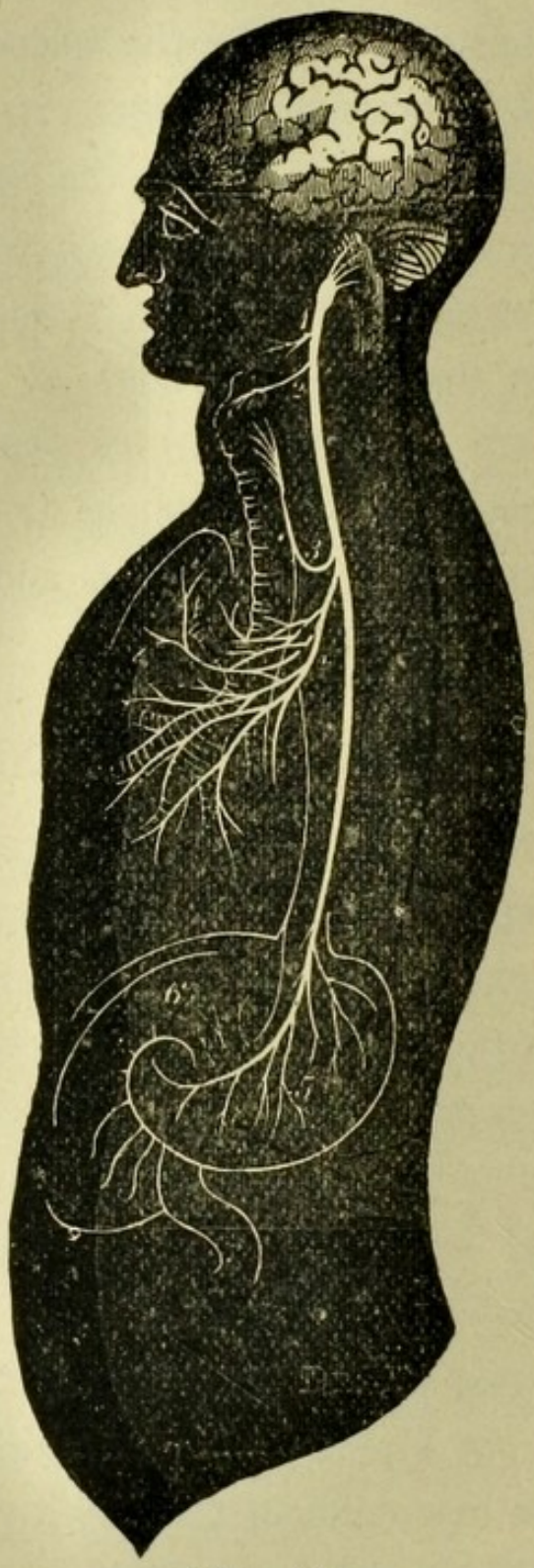

FIG. 40.

DIAGRAM OF PNEUMOGASTRIC NERVE,

showing its branches leading to the throat, æsophagus, heart, lungs, and stomach.

ately severed. This disconnected the brain from the stomach and respiratory organs, except indirectly through other less important nerves. An examination of the stomachs of these animals, showed that their food had hardly digested at all, in the length of time required for digestion to be complete in the animals whose pneumogastric nerves had not been disturbed. If, for example, the physiologist had found that four hours was the time required for digestion to be complete, he found at the end of four hours, that digestion had hardly proceeded at all in the animals whose pneumogastric nerves had been severed.

He then took other animals and fed them as the first had been fed, and also severed their pneumogastric nerves. But instead of leaving these animals as the others had been left, he attached the conductors of a galvanic battery to the parts of the severed nerves that lead into the chest and abdomen, and a gentle current of electricity was then passed into the nerves. The electricity followed the nerves and was distributed over the thousands of minute branches that were distributed to the stomach and other organs. This was similar to the nerve force that would have been distributed from the brain, if the pneumogastric nerves had not been cut. And it was found, that with the aid of electricity, the food digested just about as soon and as thoroughly as in the animals whose nerves had not been disturbed.

Most physiologists will explain this by saying that electricity acts as an irritant to the nerves and thus excites them to action. But it is our opinion, that it is the

NERVE FORCE GENERATED BY THE BRAIN

and transmitted to these organs, that furnishes the power necessary for them to do their work. That this nerve force ignites the fires, so to speak, and produces the combustion in the muscular fibers that causes them to contract, and that this force also puts into operation the glands. And that this force is either electricity, or a force so very similar, that electricity can do the same kind of work. And when the battery was applied to the severed nerves, the electricity simply supplied the power necessary for the work of digestion. Just exactly

HOW THE NERVE FORCE DOES ITS WORK,

is not well understood; but it is our opinion that it is about as follows: Each muscular fiber is cylindrical and hollow. This hollow is filled with fuel deposited there by the blood. A muscular fiber is very elastic and expansible laterally, and when it expands laterally, its length is decreased. There is a nerve fiber leading to every muscular fiber. And when the nerve power generated by the brain is sent through the nerves to their terminal

fibers, and thus reaches the muscular fibers, it immediately causes a combustion of the fuel in the muscular fibers—a diminutive explosion. This expands the mus-

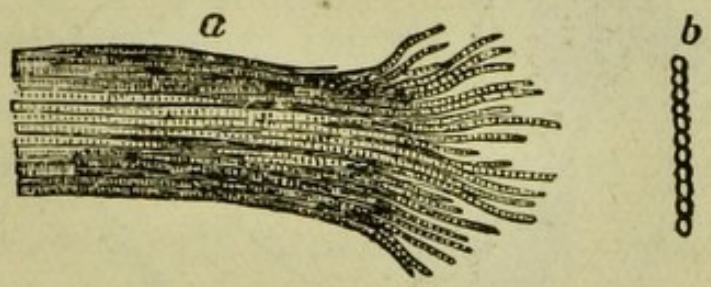

FIG. 41.

a—Bundle of muscular fibers, magnified.
b—A single muscular fiber highly magnified.

cular fibers laterally, but decreases their length. If this be true, the

CAUSE OF MUSCULAR CONTRACTIONS,

is the combustion of fuel and the liberation of force in each tiny fiber composing the muscle. And it is the nerve force generated by the brain, and directed by the mind, that causes the combustion. (Figs. 41 and 42.)

It is a well known fact, that the contraction of a muscle can be maintained only for a comparatively brief time. If you hold a weight in your hand with arm extended, it may be very easy for a short time, but it is impossible to continue to thus hold it for a very long time. The reason that it is at first easy, and soon be-

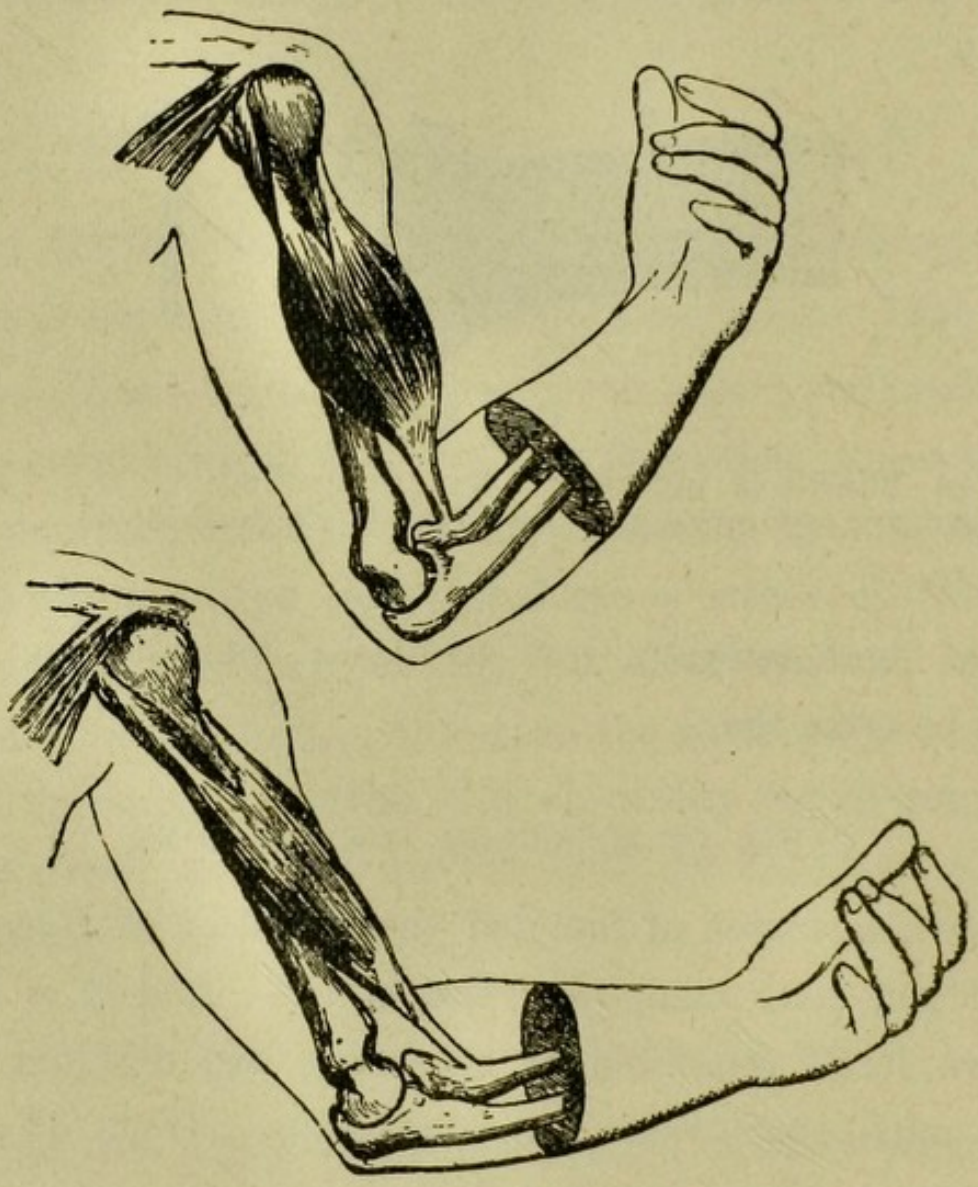

FIG. 42.

Upper part of diagram shows the biceps muscle, contracted, as in the act of lifting a weight.

Lower part of figure shows the biceps muscle, relaxed, permitting the forearm and hand to fall.

comes impossible, is because the supply of fuel in the muscular fibers is soon exhausted by the combustion. When the will first sends the nerve force to the muscular fibers and explodes the fuel contained therein, there is a full supply of force for the muscular contractions. But the effects of this force are gradually exhausted, and the lateral expansion of the muscle gradually decreases, and its length increases, and the muscle relaxes. And no amount of will-power that may be exerted to send more nerve force into the muscle, can renew the contraction until there has been time for the blood to deposit a fresh supply of fuel in the muscular fibers.

The work of all muscular tissues conforms to this law of muscular action. Walking is an alternate contraction and relaxation of various muscles. In the stomach and intestines, one set of muscles contracts and then relaxes to receive another supply of contracting force, while another set contracts. The heart and respiratory muscles also contract and relax alternately and thus conform to the same law. The muscular fibers, then, do their work on the same principles as a

GAS ENGINE.

An engine of this kind, is operated by the force generated in the explosion of gasoline. The engine is constructed in much the same way as a steam engine, but instead of the piston being forced back and forth

by the expansion of steam, in the gasoline engine, the piston is operated by the expansion of gases generated by the explosion of gasoline. This explosion is effected at the proper moment by a current of electricity or by a heated wire or tube. During the working of the engine, when its machinery reaches a certain point in its alternate movements, the circuit of electricity is connected, and a spark discharged that explodes the gasoline behind the piston, or else it is exploded at the proper moment by heat.

MUSCULAR POWER DEPENDENT UPON NERVE FORCE.

We believe that muscular contractions are effected upon this same principle :—That a diminutive explosion in each muscular fiber, is caused by the rapid combustion of fuel that is contained therein, and that this fuel is ignited at the proper moment by the nerve force. The expansion resulting from the gases generated by this combustion, owing to the peculiar construction of the muscular fibers, causes their lateral distention, and a consequent shortening.

The explosions which result in voluntary movements, are effected by nerve force that is sent to the muscular fibers by the direct action of the will. The explosions that cause the involuntary movements, are effected by the automatic machinery in the sympathetic ganglia, spinal cord, and at the base of the brain.

The strength of a muscle, therefore, depends not only upon the power of its tissues, but also upon the quality and quantity of the fuel contained within its fibers, and the efficacy of the nerve force supplied to it.

Actual experiment has proved that the nerve power supplied to the voluntary muscles, is generated by the parts of the brain found to be large in the motive temperament. We will explain this more fully in Vol. II.

CHAPTER XIV:

CHARACTERISTICS OF THE MENTAL TEMPERAMENT PEOPLE.

Having explained the machinery of the mental temperament as fully as seems necessary for our present purposes, we will now investigate the effects produced in the character and capabilities by this temperament being proportionally the largest and most influential part of the body.

And in the beginning, we should perhaps explain, that while it is quite easy to estimate the size of the brain, we can estimate the influence of the nervous system only by certain indications, and the fact that actual experience has proven, that it corresponds with the brain in the efficacy of its powers. That when we find the brain and certain signs in the body, clearly indicating the mental temperament, there is no doubt about the nerves corresponding with these other indications.

THE PHYSICAL FIGURE OF THE MENTAL TEMPERAMENT

is usually small. The muscles are small but often very dense and wiry, and very strong and effective in proportion to their size. The bones are all small and the joints

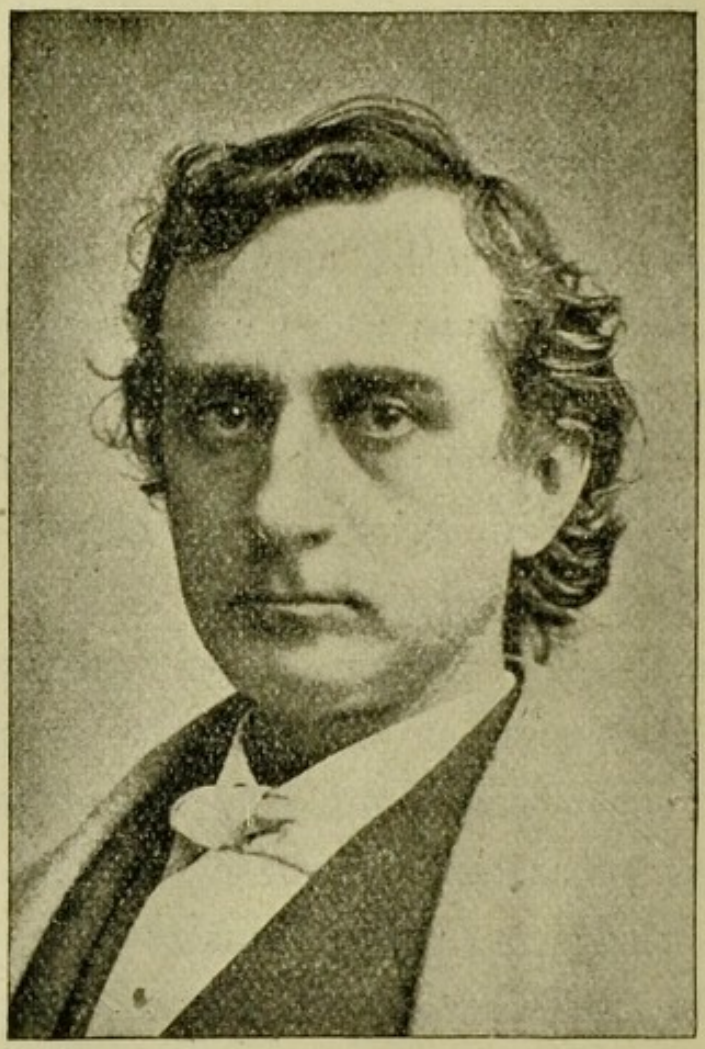

FIG. 43.

EDWIN BOOTH.

A distinguished actor. The mental temperament is very large, and it is supported by a motive temperament strong enough to render the mental especially forceful and effective, and both of these temperaments are supported by a vital temperament with strength sufficient to supply the adequate fuel and building materials.

only moderately prominent. The joints are never large, and their moderate prominence is the result of a deficiency of flesh to cover them. There is never more than a moderate degree of flesh in this temperament, and sometimes there is a decided deficiency. Persons of this temperament are slender and lithe; and, as a rule, they are rather small, but some of them are quite tall. They are never bony and angular like those of the motive temperament, and never broad and fleshy like the vital temperament people. The figure is often delicate, elegant and graceful, but not strong and commanding. The skin is delicate and fine. The hands are slender and delicate, but agile, dextrous and effective. Being covered by so little flesh, the veins are prominent and easily seen.

THE HEAD

is large in proportion to the body, particularly the forehead and upper part. The forehead, especially, is large. It is both broad and high, and it extends forward from the openings of the ears, a distance decidedly great in proportion to the size of the entire brain and body. But the head is comparatively small at the base, and in the crown—in the parts that are large in the vital and motive temperaments. The hair is usually fine, and the neck is slender.

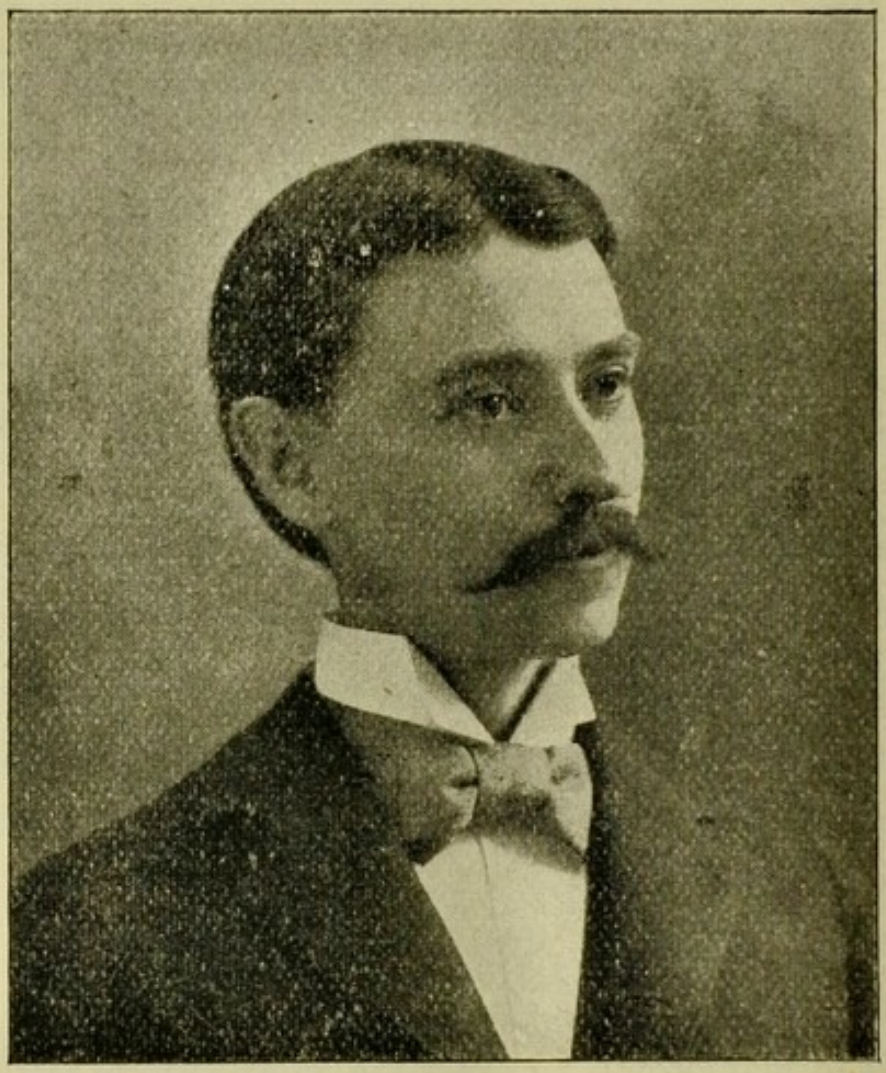

FIG. 44.

DR. E. A. WILLIS.

Mental Temperament decidedly predominates, but the face is not quite a perfect example of the typical mental temperament contour, chiefly, because the nose and cheek bones are too prominent and large, and because the forehead is not quite broad enough. The nose and cheek bones indicate more strength in the motive temperament in proportion to the mental, than is possessed by people of the extreme type of the mental temperament.

THE FACE

is broad at the top and slender in the lower part—a pyriform face. It is broad at the top because the brain in this region is large, and a broad skull is necessary to accommodate it. It is slender in the lower parts, because the bones in this temperament are all small, and those in the chin and face correspond with the bones in other parts of the body. The features are delicate, and responsive, and often very active and expressive. The forehead is usually pale, as well as high, and the eyes are most frequently, gray.

MENTAL TEMPERAMENT COMPARED WITH THE MOTIVE TEMPERAMENT.

In the light of the facts, principles and philosophy, that we have discussed in the preceding pages, it is very evident that people with the mental temperament, must have characters that are very different from those of the motive and vital temperament people.

They cannot evince the physical power, endurance and measured energy that are characteristic of the motive temperament, nor the positiveness, decision, self-reliance and assurance that is given by a consciousness of physical superiority. They cannot evince the distinguishing characteristics of the motive temperament people, because the machinery of the mental temperament cannot express those characteristics.

MENTAL TEMPERAMENT COMPARED WITH THE VITAL TEMPERAMENT.

Neither can they evince the love of physical ease and pleasure, that distinguishes the vital temperament. Nor the strategy, policy and diplomacy, that is resorted to by the vital temperament people in order to enjoy physical ease and pleasure, and to gratify the appetites, feelings and passions.

The comparative quiet to the motive and mental machinery, that the vital temperament people encourage, in order to center more of their energies in the activities of the vital temperament machinery, is, of course, distasteful to the people of the mental temperament.

The mental temperament people cannot evince the hearty, impulsive, passionate zeal, ardor and shrewdness characteristic of the vital temperament, because the mental temperament people do not have the kind of physical machinery that is necessary to express these qualities, nor the kind of minds that are necessary in order to generate the kind of thoughts, that are required to develop vital temperament bodies.

APPLICATION OF A PRINCIPLE PREVIOUSLY STATED.

But the people of the mental temperament, are equally true to the principle that we have stated in a

previous chapter, that every animal tends to exercise its largest organs most, because it can exercise those organs the easiest.

The people of the mental temperament will therefore exercise their brain and nerves most, because these are the largest and strongest organs that these people possess. Whatever are the qualities, then, that are given by large, strong and active brains and nerves, these are the qualities that the mental temperament people will evince.

THE TEMPERAMENT OF ACTIVITY AND MENTAL POWER.

As the brain and nerves generate and convey the nerve force that ignites the fires in the body's various muscular tissues, these fires will be ignited freely or otherwise, in proportion to the size and power of the brain and nerves.

The more freely these fires are ignited in the various muscles, the greater will be the activity in these organs. The mental temperament will therefore be a temperament of activity. But igniting the fires in all parts of the body, is only a part of the work done by the mental temperament. And it is only a part of the brain that is engaged in this work.

A large part of the brain is employed to classify and express thoughts, feelings, emotions, sentiments and

passions. But these parts of the brain, except those used by the mind to classify and express thoughts, are the parts that are more intimately related to the bodily machinery of the motive and vital temperaments, and are, consequently, not large in the mental temperament. The

FORWARD PART OF THE BRAIN

being the part that is especially large in the mental temperament, and this part embracing the organs that classify and express thought, these people of the mental temperament, will, therefore, be strong and active in intellectual work.

The mental temperament people, will therefore be characterized by a combination of activity, intensity, intellectual power and concentration of mental effort.

The individual characteristics resulting from this combination, may be summed up as follows.

CHARACTER OF PERSONS WITH THE MENTAL TEMPERAMENT.

These are the world's intellectual people. The students, scholars and profound thinkers. Their greatest power lies in the intellectual part of their brains. This is the part of their mind's machinery that it is easiest for them to exercise, because it is comparatively the largest and strongest. And they are never happier than

when they are exercising the intellect in conversation, reading, study or meditation. They are very

QUICK, ACTIVE AND INTENSE,

both in mind and physical movements; too high-strung, imaginative, sensitive and refined; too susceptible and highly animated; constantly inclined to overdo, because their activity, intensity and energy far surpass their powers of physical endurance; their machinery that generates nerve force, is powerful and active and they have such an abundance of this nervous energy, that they explode the fuel in their tissues faster than the vital temperament can supply it, and the result is often a collapse;

NERVOUS PROSTRATION

in extreme cases. In the milder form and before nervous prostration ensues, it is exhibited in periods of great animation, activity and intensity, followed by an exhausted, tired "nervous," worn-out, over-done and mildly collapsed condition; they enjoy study and light, quick, active work; are too much alive, and will be early exhausted and prematurely die if they follow their natural inclinations and do not curb the constant tendency to work beyond their strength; these people are thoroughly in harmony with the

FIG. 45.

ELLA WHEELER WILCOX.

Popular writer of both prose and poetry. A superior mental temperament with a motive temperament well enough developed to give strength to the mental, and a vital temperament strong enough to add warmth, buoyancy, animation and ardor. A superior organization.

RIFINED, PURE, DELICATE AND CLEAN;

they are literary and scientific, and are often artistic and musical; they are frequently very intuitive, and are given to day-dreams and flights of the imagination; these dreamy, half-abstracted wanderings of the imagination are often crystalized in the finest of poetry and artistic productions, that seem to have resulted from no definite purpose nor previous plan, and in a way that seems to be contrary to the recognized laws of thought and reason; and they hardly know how nor from whence they got their ideas.

Refinement, taste,

VIVIDNESS OF CONCEPTION,

intensity of emotion, sensitiveness, and love of the beautiful, elegant and perfect, in both nature and art, are marked characteristics of this temperament. The thoughts of these persons are quick, the senses acute, the imagination lively, and the moral sentiments are usually high; they have too much activity for their physical strength, and their brains are too large for their bodies; they have thin lips, sharp features, sharp teeth, and a thin, pointed nose; they are characterized by a

PREDOMINANCE OF MIND OVER BODY,

so that the state of the mind effects the body more than the body effects the mind; are exceedingly susceptible

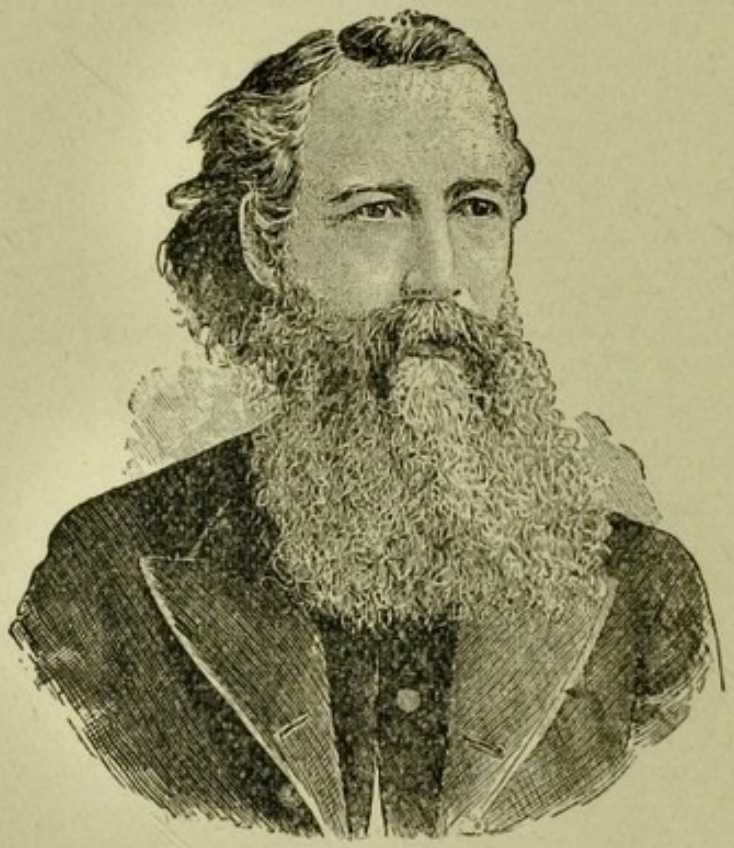

FIG. 46.

HIRAM E. BUTLER.

Author. A fine mental temperament in a high state of health.

to stimuli, and all exciting thoughts, food and drinks; are very delicate in feeling, thought and expression, and are easily disgusted with any thing coarse, vulgar or not in good taste; enjoy and suffer in the highest degree; when happy, are very happy, and when sad, are very sad; have great extremes of feeling and emotion, either the one way or the other; their physical sensations of pleasure, are of the highest order, and their physical suffering is of the keenest kind; they experience a vividness and intensity of emotion, and a clearness, pointedness and rapidity of thought, perception and conception, and a

LOVE OF MENTAL EXERCISE,

that are imparted by no other temperament; they are very eager in their pursuits, and feel that their plans and objects are of the utmost importance and demand the most prompt and energetic action, now; consequently they are almost sure to overdo and exhaust their physical powers, which are not strong enough even when rightly used; they are very fond of reading and study; of thinking and reasoning; of books and literary pursuits; of lectures and all kinds of information, and are apt to lie awake at night, thinking or feeling, reading, reasoning, or planning; they

INCLINE TO A PROFESSION

or some kind of mental work, and can excel in occu-

pations requiring activity, directness, and a quick, prompt, decision; are well adapted to the work of a stenographer, typewriter, postal clerk, etc.,—something requiring great activity and energy, but not great muscular power; head-work rather than hand-work; they have plenty of nerve force, and the kind of muscular energy required for quick, light work, but are deficient in the brute strength that excels in heavy muscular labor.

Poets, ministers, artists, teachers, scientists and all other literary and intellectual workers that are especially proficient and distinguished for originality of thought, have the mental temperament strongly marked, and often greatly predominating.

It is the natural tendency of the mental temperament people, to neglect the exercise of the motive and vital temperament machinery, that is necessary to health. And to enjoy the full benefits conferred by their magnificent mental powers, they must take more physical exercise than their natural inclinations favor.

It is, of course, only the extreme type of the mental temperament to which the foregoing enumeration of characteristics, applies in full. In the modified types, these characteristics are modified.

THE END OF VOL. I.

APPENDIX.

REPRODUCTIVE TEMPERAMENT.

All the organs of the body except one class, are included among those mentioned in the classification of the temperaments as given in this book. The class that has not been mentioned, embraces all the organs immediately related to parentage. That class of organs is not considered in works heretofore written upon temperament and character reading, but no work upon these subjects can be complete if it omits to explain the effects that this class of organs exerts upon character and capabilities. As we have no intention, however, of attempting to make this book an exhaustive work upon those subjects, we will mention only a few facts which we trust will prove sufficient to briefly explain our meaning, and to give the reader a general idea of the influence that these organs exert.

Among the facts which indicate the necessity of considering the reproductive system, in order to accurately estimate the tendencies, powers and capabilities of men and women, we mention the following: The strength and activity of the organs of parenthood, are

sometimes so great that other parts of the body are depleted. In some men, these organs are so influential, and so much of the body's vitality is expended in their activities, that there is not enough stamina left to accomplish anything of any importance in any line of physical or mental effort. And these men are often those, who, except for the expenditure of an undue amount of their forces in this way, would be men of energy, talent and efficiency. They are often men who have abilities that are in demand in the markets of the world, and whose labor could be sold for excellent prices. But the vitality being exhausted by an excessive expenditure through the reproductive system, there is not enough power left to exhibit any great talents of any kind. And a man, otherwise, with superior abilities, is unknown, because he fails to maintain within his body, sufficient vigor to properly express his natural talents. And it is often only by determined effort and a persistent exercise of their various physical and mental organs, that these men can overcome this tendency to a wasteful expenditure of reproductive energies, and a consequent drain of all vitality.

Others have sufficient superiority in reproductive powers to enable them to become the fathers of children of the highest order, but not enough reproductive energy to lead them to waste their vitality in excessive activities of the reproductive system, and to thus destroy all their physical and mental powers and talents.

Other men are just as emphatic examples of the

the other extreme. Some men have not enough strength and activity in the reproductive system, to beget children above mediocrity. Many men of national, and even inter-national reputations, have so little strength in the organs of parenthood, that they cannot beget children with talents above the average, and sometimes their children are actually inferior. An examination of the pages of history, reveals numerous examples of great men whose children were possessed of only common-place talents, and sometimes they have actually been decidedly inferior.

Equally good, and perhaps more convincing examples of the influence exerted by these organs, especially to the mind of a physician, are to be found among women.

Some ladies are the mothers of fine, large, strong, healthful, talented children. The children of others are small, puny, sickly, peevish,weak and inferior in mentality. Some mothers nourish their babies thoroughly. And some furnish even more nourishment than their babies can appropriate. Others cannot furnish sufficient nurse to keep their babies alive. The children of some ladies are superior to their mothers. Those of others, inferior. Some mothers give themselves almost entirely to their babies, and exhaust themselves. Others cannot give enough of their strength to their babies, to develop children vigorous enough to live. And the

ladies who have the inferior children, are often more strong, vigorous and talented than the mothers of superior children. But they retain nearly all of their strength themselves instead of bestowing a sufficient part of it upon their children. And some women cannot become mothers at all, because they keep all their vitality for themselves instead of bestowing part of it upon offspring. It is very evident that the woman who is dividing her vitality with her babies, both before and after their birth, will exhibit capabilities in other things that are very different from those who cannot bestow enough vitality to become mothers at all. The woman who unduly depletes her forces in reproduction, cannot have enough energy to expend in other directions, to enable her to exhibit the same talents and powers as she who does not suffer this drain. This will appear more plain in the light of the facts and principles discussed in the body of this work.

We trust that these few brief remarks will serve to explain why we insist that a work upon the temperaments, cannot be complete without discussing, at least briefly, the effects that the organs of parenthood have upon character and capabilities. And in this connection, we will speak of those who have the ability to parent superior children, as persons of the *reproductive* temperament.

To be entirely logical, then, in discussing the tem-

peraments, we must consider five classes instead of only four, as is the plan pursued in works heretofore published. We shall therefore insist that the following is the only accurate and

COMPLETE CLASSIFICATION OF THE TEMPERAMENTS.

- MOTIVE,
- VITAL,
- MENTAL,
- REPRODUCTIVE,
- BALANCED.

But, for various reasons, we have deemed it more practical in this work to follow the usual custom. And, with the few remarks already given, we dismiss the subject, except to state that the author's views regarding the reproductive temperament, are fully discussed in his work entitled "The Doctor's Plain Talk to Young Men," the fifth edition of which is already published; and also in a work especially for ladies, that he expects to publish about February or March, 1902. This work is entitled "The Doctor's Plain Talk to Young Women."

BOOKS.

Readers of "The Mind and Its Machinery," who are not familiar with anatomy, physiology, chemistry, etc., are referred to the following list of books, treating upon these subjects. The cheaper books are elementary, and are the kind used in our common schools and academies. They are all that the average reader will want. The more expensive books, are used in medical colleges.

	PRICE
Kellogg's Second Book in Physiology and Hygiene...	**$0.80**
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Huxley and Yoman's Physiology.....	**1.60**
Foster's Physiology.....	**3.75**
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"This book is written with sincere purpose and sane judgment. Its influence is entirely wholesome."—*Harvard (University) Illustrated Magazine.*

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