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Normal Standard of Physiology.

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NORMAL STANDARD OF PHYSIOLOGY.

Nathan Allen, M. D., in the New England Medical Monthly.

It is admitted that Prof. Huxley is the highest living authority on matters pertaining to physiology. The following table, prepared by Prof. H., defines the constituent elements that compose a perfect human body. It describes exactly not only all of its principal parts, but what supplies it must have, from day to day, to preserve it in a healthy state.

This table reads as follows: "A full-grown man should weigh 154 pounds, made up thus: muscles and their appurtenances, 68 pounds; skeleton, 24 pounds; skin, 10½ pounds; fat, 28 pounds; brain, 3 pounds; thoracic viscera, 3½ pounds; abdominal viscera, 11 pounds; blood which would drain the body, 7 pounds. This man ought to consume per diem, lean beefsteak, 5000 grains; bread, 6000 grains; milk, 7000 grains; potatoes, 3000 grains; butter, 600 grains; and water, 22,900 grains. His heart should beat 75 times a minute, and he should breathe 15 times a minute. In twenty-four hours he would breathe 1750 cubic feet of pure air to the extent of 1 per cent.; a man, therefore, of the weight mentioned ought to have 800 cubic feet of well ventilated space. He would throw off by the skin, 18 ounces of water, 400 grains of solid matter and 400 grains of carbonic acid every twenty-four hours, and his total loss during the twenty-four hours would be 6 pounds of water, and a little above 2 pounds of other matter."

This description represents a harmony or balance of human organization which, we believe, has practically very important bearings. We have in this description, set forth to a certain extent, both the anatomy and the physiology of the body—the structure in the fore part, and the function in the latter part. This organization may very properly be considered the *normal standard* of the human system—that it is represented here in its best estate. While we may not, perhaps, find perfect examples—like the organization here described, we find all manner of approximations towards it. Still the standard remains the same, and upon it are based, we believe, certain great physiological laws which are fundamental and vastly important. Some of these laws we propose to notice briefly in this article, but it would require volumes to do justice to them.

I. *The Law of Health.* In analyzing this table we might almost scientifically figure out the exact changes which cause disease. There must be in the very nature of things, one kind or type of organization more conducive to health than another. Admitting this fact, there must be an organization of the body far better adapted to secure perfect health than all others. What then must be its type or character? What must be its anatomy and its construction? Is not that the standard which consists in a perfect development of all the organs of the human body, so that there shall be a perfect harmony in the performance of their respective functions? By referring to the table it will be seen at once that a change in the weight or measures pertaining to any part of the body will make a radical change in the type or standard set before us. If you change any one of these factors, you destroy the harmony or balance in the whole organism. If the structure is changed, it impairs just so much of its functions. This constitutes the entering wedge of disease. The particular kind of character of the disease must depend upon what organ or part of the body is changed. By referring to the table we find certain directions given as to the support of the body. If there is a failure to carry out these directions, or if there is any material change in the character of the supplies, disease may not at once be produced, but the vital forces of the system may be lowered, or some weakness started. The first changes may be slight in their character, but lead to serious results. Some of the gravest diseases originate from the most trivial causes.

There are, it may be said, different degrees of health; this fact is very obvious. What makes the difference? It is not because this or that organ alone is sounder in one person than in another. It is not simply because one person takes so much better care of himself than another, though this makes quite a difference. If we bring together all the causes or reasons, we shall find that the secret consists in the fact that the constitution of one is more perfectly and evenly developed—that there is greater harmony and completeness in the performance of the functions of all parts of the body. There must, therefore, be a *general law* regulating this whole matter of health—some standard, some type of organization better than all others. As far as figures can explain it, we find it described in the table at the head of this article. In other words, it consists in that type or standard where every organ in the human body is perfect in structure, and where each performs perfectly its own legitimate functions. In some respects the body may be compared to a complicated machine, so thoroughly and perfectly made that the "wear and tear" will come equally upon every part according to the design in its construction.

Closely connected with, and legitimately following this condition of things, we find nature has established another law, viz.:

II. *The Law of Longevity.*—Is there not some standard or model laid down by physiology itself, that shows why, in certain cases, life should be protracted to a great age? It does not depend upon food, climate, locality, race or care, though all these may have much to do with it. Is there not an *internal factor* more potent than all these? One of the great secrets, we believe, not only of good health but of long life, consists in the harmony or balance of organization. This must apply both to structure and function. The leading vital organs should be not only sound but well balanced. The principal forces in carrying on the functions of life may be summed up under these heads: Respiration, digestion, circulation, assimilation and secretion. Each of these departments must be well sustained in order to secure long life.

But, aside from any theory or opinion or argument, what are the actual facts—what do we find in the organization of those persons who have reached a very great age? No tables or statistics can be given from post-mortem examinations of such cases, because attention has not been turned in this direction. But, from the physical description of a great number of very aged persons, and from careful observation also, of a very large number, we have always found that a most striking harmony or balance of the physical system prevailed. In great longevity there is uniformly found remarkable consistency or evenness in the mental, moral and social elements of character. These traits originate from a sound and well-developed brain. This organ plays a very important part in securing longevity.

There is another argument in favor of this law of longevity—that the extremes in physical or mental development seldom reach a very great age. It should be borne in mind that the law of longevity here advocated constitutes the golden mean, or balance-wheel between these extremes. For instance, the defective classes, such as the insane, the idiotic, the deaf-and-dumb, the blind, etc., are not, as a body, long-lived. Neither are dwarfs or giants, nor persons approximating such organizations, very long-lived.

There is another very important factor in longevity—that is, *inheritance*. Scarcely any truth on this subject is more firmly established than that the ancestry, the family or stock has much to do with long life. Seldom, if ever, do we find a person reaching a great age without some one or more persons in the ancestry have reached a great age. What, then, is the peculiarity or type of organization here perpetuated? What are its elements that make life so long? Do we not find that they consist in a sound, healthy structure of every part of the body, and that there is a remarkable balance in all the organs, and a harmony of functions? So universally is this essential element found in persons long-lived that we question whether a single exception to the rule can be found. This leads to another application of this normal standard of physiology—that upon it is based the

III. *Law of Heredity.*—For centuries there has been more or less interest on this particular topic. A large mass of facts have been gathered upon the subject, and physiologists now generally admit that there must be truth in this matter of inheritance. Within a few years the interest has greatly increased. In the case of domestic animals the principle has been reduced almost to a science. With some changes or modifications, the same principle which has been so successfully applied to the animal creation will apply to human beings. But before there can be great advances on the subject, we must understand heredity better—we must have some general law or principle to guide us. What we need more than anything else, is a general principle or law by means of which all the facts or knowledge of this kind can be classified and reduced to some system. It is impossible to make any great advances or improvement upon the subject of heredity without such a guiding principle or standard of appeal. In the facts or phenomena of nature, there must be some general law or principle to guide us in understanding them, and improving upon them. All science makes progress only in this way.

While there may be different factors, and secondary causes in producing many of these hereditary phenomena, if the primary cause or starting point could be ferreted out, we might find it to extend back several generations. All the general principles of science, when traced back to their origin, are based upon nature in its best condition. And the nearer we can go back to a perfect physical organization the less peculiarity, eccentricity, or defect shall we find. It may be we cannot explain or understand all the causes of the strange or different phenomena of character; it does not disprove but there may exist a general law somewhere. It is true, there have been different theories and speculations in accounting for hereditary influences, but we do not believe that they can all be explained so satisfactorily upon any one other law or hypothesis as upon the one here stated—that is, upon a perfect development of anatomy and physiology, or in other words, that all the organs in the human body shall be so constructed that there must be legitimately a healthy performance of all their functions.

There is another important test in favor of this normal type of physiology—as far as the human body is concerned, it presents the true *standard of beauty*. Man was created with a sense of taste and love for the beautiful, which, cultivated and perfected, might find objects in nature capable of gratifying this taste to its fullest extent. Now there must be a type or model for man, which in form, proportion, size, fullness, outline, is more beautiful than all others. Is not this the same standard that Grecian and Roman artists have attempted to imitate in statuary? Has it not, in all ages, and with all nations, attracted attention? Why should it not constitute the basis or foundation for most valuable laws? But the most important law of all, involved in this physiological description, remains to be stated, that is

IV. *The Law of Human Increase.*—This law virtually controls all the others. With a change here, the conditions of health, of longevity and of heredity would necessarily be more or less affected. It is in fact, the starting-point, the groundwork of the most important inquiries that can be raised connected with physiology. All that we can here do is to state what this law is, what some of the evidences in support of it are, and what are some of its applications. It would require volumes to do justice to the whole subject.

In the first place, there is no universal law of population that is generally admitted as such, and referred to as authority. Nearly one hundred years ago, Malthus established what he supposed a general principle to regulate population, and his theory prevailed for fifty years or more. It is discarded now by nearly all physiologists, as well as most writers on political economy. It is rare to find now any prominent writer advocating the doctrine of Malthus. The theories of Herbert Spencer on this subject have, probably, at the present day, more influence than those of any other writer. The views of Spencer, unlike those of Malthus, are based upon physical organization, but are not so strictly physiological as the law here proposed. The foundation, the groundwork of the law we advocate, is based solely upon an-

atomy and physiology in their best estate. There are other factors, such as food, climate, exercise and other external agents, but these are secondary.

That this law may be distinctly understood, we will describe, as briefly as possible, what is meant by it. It is based upon a normal or perfect physical standard of the human system, where every organ of the body is complete in structure and performs fully all its natural functions. This principle implies that the body is symmetrical, well developed in all its parts, so that each organ acts in harmony with all the others. According to this principle the nearer the organism approaches that standard, and the laws of propagation are observed, the greater will be the number of children, and the better will be their organization for securing the great objects of life.

On the other hand, if the organization is carried to an extreme development in either direction, viz.: a predominance of nerve tissue, or of a low animal nature, the tendency in such families or races is gradually to decrease and ultimately to become extinct. Thus people enjoying the very highest civilization, or living in the lowest savage state, do not multiply rapidly. It is well known that the families in Europe belonging to the nobility or aristocracy, whose nerve tissue has become predominant by inter-marriage from generation to generation, do not increase much, and not unfrequently these families become extinct. A similar result has also followed the inter-marriage of relatives from the fact that the same weaknesses or predispositions to disease are intensified by this alliance. On the other hand, in case these relatives have healthy, well-balanced organizations—it may be they are cousins—they will abound with healthy offspring, and the stock may improve, and not deteriorate, from the mere fact of relationship. It explains a principle that has long been employed in the improvement of domestic stock under the terms, "breeding in-and-in," and "cross-breeding."

Again: One of the strangest things has been taking place in the birth-rate of our New England people that can be found in history. It has diminished more than one-half within two or three generations, while that of the Irish, the English and the German, living right among us, is twice as large as the American. Why this change and this difference? Making allowance for the "arts of prevention and destruction," which doubtless exist to some extent, we do not see how this great decrease of birth-rate can be accounted for, except by some radical change or difference in physical organization. In connection with this decrease of birth-rate, we find this very significant fact—that probably not half of our New England women can properly nurse their offspring at the present day. It was not so formerly, and the Irish, English and German women find no such difficulty. Has there not been a great increase of nerve tissue among our women, and at the same time a loss of lymphatic and muscular? Some may think this change of small account, but if the very existence of a people is imperiled—at least in three or four generations—it is certainly a question of some consequence. We close with one suggestion. Man was created a free moral agent, responsible for his acts. The law of propagation is certainly very important to man in his relations to this world and the future. Must man always remain ignorant of such a law, or pass through life a mere passive agent in its administration, without definite knowledge on the subject, or intelligent motives set before him for his action? It is impossible that a wise and just Creator should ever have had such a purpose or design.

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