Introductory lecture to the course of medical institutes, in the University of Pennsylvania : delivered November 4, 1842 / by Samuel Jackson.

INTRODUCTORY LECTURE

TO THE

COURSE OF MEDICAL INSTITUTES,

IN THE

UNIVERSITY OF PENNSYLVANIA,

DELIVERED NOVEMBER 4, 1842.

BY SAMUEL JACKSON, M.D.

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CORRESPONDENCE.

Philadelphia, Nov. 5, 1842.

Dear Sir,—The Medical Class of the University of Pennsylvania, through us, as their Committee, express to you their gratification, for the useful and highly instructive lecture addressed to them on the 4th inst., and, should it accord with your wishes, respectfully solicit a copy of the same for publication.

With high esteem, your friends and pupils,

Th. H. Laird, Va.
Jno. R. Wilson, Va.
Wiley Jenkins, Miss.
Tho. C. Arrington, N. C.
Wm. N. Raines, Va.
Benj. F. Jones, Alab.
Wm. O. Morrison, La.
Matt. Gayle, Alab.

To Professor Samuel Jackson.

Philadelphia, Nov. 5th, 1842.

Gentlemen,—It would give me pleasure at any time to comply with a request of the Medical Class of the University of Pennsylvania—I cannot refuse that which, as their Committee, you have conveyed to me in your note of this morning. A copy of the lecture is placed at your disposal.

Accept, gentlemen, the assurances of respect and esteem, of

Yours truly,

Samuel Jackson.

To Messrs. Thomas H. Laird, Jno. R. Wilson, Wiley Jenkins, Tho. C. Arrington, Wm. N. Raines, Benj. F. Jones, Wm. O. Morrison, Matt. Gayle.

INTRODUCTORY LECTURE.

KNOWLEDGE is acquired by labour. No royal road, along which the student can roll with luxurious ease, conducts to the steep ascent of Science. It is a rugged path, trodden with slow and painful steps.

Knowledge can be acquired only by patience, application, persevering and toilsome research. It never comes by intuition, even to the most gifted minds, and it is not embraced within the small and sacred precincts of revelation.

Man is an intelligence, the centre of a world of mysterious phenomena. They press every moment on his senses, and he is compelled by his wants, physical, moral and intellectual, excited by innate instincts and desires, to know and to investigate them, in their relations to himself and to each other.

The material world with its phenomena and forces, its laws and its movements, are placed at his disposition. He has, working on them, extended creation; he has formed a new world. Agriculture, the fine and the mechanic arts, navigation, the sciences, philosophy, are the results of his power in moulding and fashioning the crude things of this earth to the satisfaction of his necessities, and still more, to appease the internal craving, the insatiable appetite of the soul, that seeks to find in nature, the reality of the innate conceptions, implanted in the mind, of the perfect, the beautiful, and the true.

When we reflect on the limited means man possesses for the acquiring of knowledge, it is a subject of astonishment that he should have accumulated so much. But when we compare that which is known to the vast unknown that every where surrounds us, it shrinks into a small space; and it must be confessed, that, notwithstanding our arts, our

science, our philosophy, human knowledge is no more "than a thin crust spread over the depths of the unknown."

Various difficulties beset the acquisition of knowledge, and impede its progress. Some consist in the time and labour required in observing phenomena, and in calculating the laws that govern them; the phenomena being simple and the calculations of one order. Such are astronomical observations and calculations. Others are connected with the complex nature of the phenomena themselves, and the relations they hold to distinct sciences. They can be readily observed; but as they are not simple, they can be known in their true character only when broken up and reduced to their component phenomena. While understood as simple, while regarded in one aspect, they lead to erroneous conclusions and false principles, baffling the attempts to give to science, which is the accurate knowledge of phenomena, stability or certainty.

Compound phenomena may be seen in as many different lights as their components are viewed separately. They may be explained in as many different modes, and by as many different principles, as the individuals who observe them limit their examination to the aspect in which the phenomena regard the particular science, the observer is most familiar with.

This is the kind of difficulty that embarrasses the study of the phenomena of living beings, and has retarded, heretofore, the progress of the physiological sciences. Not one phenomenon of a living being, even the lowest in the animal scale, can be said to be simple, and can be properly understood by the knowledge of any one class of natural phenomena. These remarks apply with greater force to the more complicated phenomena of the higher classes of animals, and especially to those of the economy of man, the most intricate mechanism, the most complicated and perfected of the works of God in this, our earth's sphere.

The phenomena that, in their combinations, form the

whole and perfect life of man, are more numerous and more different in their nature ; are more closely interwoven with each other, and, consequently, less susceptible of ready analysis, than are the phenomena of any other of the works of creation.

In the economy of man, the following classes of phenomena are existing :—1st. Vital, creative, or formative phenomena, or those the result of actions producing organization. 2d. Dynamic phenomena, or the forces of the nervous system, causing movements. 3d. Chemical phenomena, or the various chemical actions composing the organic functions. 4th. Mechanical phenomena—those that result from the action of the apparatus moving the body, parts of the body, or of the fluids. 5th. The Psycological phenomena, or those of the soul and understanding.

At different periods, all the phenomena of the living economy, have been referred to some one of the preceding series. An exclusive and single view was then taken, and all the series of the above phenomena, by a violent hypothesis, were forced into one class. In this manner originated, and continued to prevail, for shorter or longer periods, the various doctrines and systems of Medicine ; not always harmless, as a false practice often followed from a false doctrine.

The metaphysician, Sthal, regarded all the phenomena of life as the direct result of an intelligent anima, or immaterial principle.

Willis, familiar with the dynamic phenomena of the nervous system, identified the anima of Sthal with the nervous forces, and he assigned to them all the living phenomena of the human economy.

The present doctrine of the German and French Physiologists, that confounds together the nervous force and vital principle, as one and the same, is the direct lineage of that of Willis.

The chemist, Silvius de la Boe, had no difficulty in ex-

plaining, on chemical principles, the living actions. He founded the chemical doctrine of medicine, which long ruled in the schools of Germany.

Borelli, the mechanician, could prove in a satisfactory manner to himself and followers, on strict mechanical principles, that the human economy was a mere machine, and all its natural and diseased phenomena, were dependant on the relations of spheres, and cones, and angles to each other.

Boerhave, who was both a chemist and a mechanician, amalgamated the two doctrines, the chemical and mechanical. He could recognize the phenomena of these two classes, and he formed from them his own, an eclectic doctrine, that did not survive its author.

The doctrines of Hoffman, Cullen, Brown, Rush and Broussais, are mainly based on an imperfect knowledge of the dynamical and mechanical forces and phenomena of life, as exhibited exclusively in the solids; and have necessarily fallen from the imperfect and narrow bases on which they were erected.

At the present day, there is no general doctrine in Medicine. The more extended and intimate knowledge we have acquired of the diversified phenomena of living beings, deters from any attempt of the kind. Our increased knowledge has shown to us how little we do know, how many wide gaps are to be filled up, before the whole series and connexion of facts in the animal economy can be made out. A successful generalization at the present day is obviously an impossibility.

Though no general doctrine of Medicine is now taught, yet special theories, that are themselves limited and exclusive, continue to be promulgated. Thus the French and German physiologists explain all vital phenomena by a nervous matter, either diffused amorphously throughout the whole structure, or separated into organs. Life and nerve-power, are, with them, identical. Others explain all the

organic phenomena, digestion, nutrition, secretion, by a "vital action," of which the capillaries are the instruments. The phrases "vital action," and "capillary action," are made to explain all the phenomena of living beings.

An apt illustration of this observation, is presented in the theories of inflammation, found in the surgical and pathological works of the day. The present doctrines of inflammation, are founded on the observations and experiments of Hastings, Kaltenbruner, Wilson Philip, Thompson, and especially Gendrin. They turn principally on supposed actions in the capillaries. The subjects of these experiments were cold blooded animals, and the inferences were drawn from movements that were believed to take place in the capillary vessels, from motions seen in the blood corpuscles. But it is now established, and I have verified the fact by experiments, that these animals are not susceptible of inflammation and suppuration. Inflammation cannot be produced in their tissues. The phenomena observed in them could not, therefore, resemble those of inflammation occurring in warm-blooded animals. It is clear, that the essential characters of inflammation, an affection that belongs to warm-blooded animals, could not be discovered, by the experiments that were made on cold-blooded animals for that purpose. In all these experiments, a most important circumstance was overlooked. An action of capillaries, contraction or dilatation, was inferred, for no such movements could ever be detected in the vessels themselves, from the movements that were observed in the blood corpuscles. But the agents employed in the experiments, are most of them capable of acting chemically on the blood corpuscles, which have a certain innate capacity of action. These active agents, when applied to the delicate, transparent tissues, are instantaneously mingled with the circulating fluid by endosmose, and thus brought into direct contact with the blood corpuscles. The motions observed in them, are the result of this direct action, between them and the chemical or other agents of the experiment. These

movements are entirely independent of the capillary vessels in which the blood-corpuscles are contained with the transparent blood. In some instances, as when ammonia is employed, the coloring matter of the blood-disk is separated, escapes by exosmose, and it dyes the tissue, without the slightest arrest, or any other change in the circulation.

Other oversights, it is not necessary now to dwell on, were committed. These are sufficient to show, that the present received doctrines of inflammation, are founded on a basis, not only too narrow and exclusive, but actually a false one. If we do not, therefore, entirely reject them, we must, at least, look on them with suspicion, and hold them in distrust.

Gendrin, whose observations are the most particular, and which are considered the most conclusive, and to be relied on, must have permitted his imagination to delude his perceptions, as he minutely describes to have seen, what is now demonstrated never could have occurred. He represents, as having witnessed passing under his eye, the conversion of blood corpuscles into pus-globules, in the web of a frog's foot, and the mesentery of a frog. Here are two palpable errors, or rather impossibilities. First, inflammation cannot be produced, nor pus formed in frogs. Second, the pus-globule is never formed from blood corpuscles, but from exudation cells, that are never thrown out in that class of animals.

The foregoing remarks are sufficient to show, that errors are unavoidable, when the complex phenomena of living beings, are examined in a single relation.

I have, therefore, selected as the subject of this discourse, an examination of the different kinds of actions composing the complex phenomena presented to observation, in the living and acting organism of man.

In every living and acting being, organ, or tissue, three rudimentary elements always exist in a dependant and indissoluble connexion. These are—1st, the organizable fluid, plasma or blood, of which the organic structures are

formed; 2d, the organic solids, the products of the organizing force, and the instruments of vital movements; 3d, the forces of life—the first cause of all vital actions and phenomena. In no vital action can these be separated. Whatever doctrine or theory in medicine, whether general or special, that does not embrace each and all of these, and assign to them their appropriate part, must be partial and erroneous. Every action of the living economy, whatever its nature, must require their conjoined operation. They are the mean, by which it is produced.

The phenomena manifested in man, it has already been said, are the following: 1. The vital, organic phenomena, the direct result of the rudimentary force of life, or vital principle. 2. Dynamic phenomena, or the varied movements and actions, produced by the nervous or acting forces of life. 3. Chemical phenomena, or those consisting of changes in the chemical equivalents of the organic matter, in the functions of digestion, respiration, nutrition, secretion. 4. Mechanical phenomena, or those connected with the physical movements and condition of the economy. 5. Psycological phenomena, or the intellectual and moral faculties.

A very summary review of the nature, characters and distinctions of those different phenomena, will now be presented to you, as the starting point of the investigations, that will occupy the course of this chair.

The Institutes of Medicine, you will recall to your recollection, as explained on another occasion, are engaged in the investigations of the numerous and varied phenomena of the acting organism of man, in health and disease, the basis of the Science, Philosophy and Practice of Medicine.

I. The first class, or the vital, organic phenomena, are the direct result of the action of the vital or organic force, or principle. This principle is the first cause of all vital phenomena, but its manifestation is restricted to one order of phenomena—organization, the production of forms, the

creation, out of the formless primary plasma, or organizable substance, organic forms. The essential character of every proper vital, or organic action, is that of formation or organization.

By the perfection given to the microscope, and its application in skilful hands to the study of the developement of living beings, and their organs, vegetable and animal, from the first instant of vital activity, through all their succeeding phases, the distinctive characters of the purely vital actions have been determined. The proximate fact of life has been reached. This is the highest point of positive science, attainable by the human intellect. It is the first link, from which depend all the succeeding facts of science.

This proximate fact of the vital or organizing Force, is the creation of form. Three modes of organic formation, appear to result from the operation of the vital force. The first is the production of the rudimentary organic cells, in the primary formative substance. Each cell is a perfect organism. It is as distinct a living being, as are the polygastric infusoria. They possess especial aptitudes; they pass through periods, or ages of production, increase and decay; and when dead and effete, their elements or their remains are rejected from the economy, in the form of the excretions.

The second mode is the conversion of the primary organic cells into secondary organic tissues, or structures. The living organic cells, by their inherent force of life, acting on the plasma, or primary formative substance—albumen, absorbed by endosmose—change the order of its chemical equivalents; the cells disappear, become converted into blood corpuscles, into cellular tissue, nerve tissue, muscular tissue, vascular and other tissues.

The third mode, is the production of organs, and apparatus of organs, for especial offices, and the completion of the being in an external form. When we survey the numerous forms of organic nature, the mind is lost in admiration. The numbers, when we consider the external forms

of vegetables and animals, and the forms of the internal organs and structures, must count some millions or more. No confusion prevails; all is order and uniformity. Each form has continued unchanged, from the commencement of creation. Every individual, and each separate organ, have been constantly reproduced after one type; and that type is the most perfect idea of intellectual wisdom. For each organic form presents an unimproveable adaptness of means to an end. Where are we to look for this type, this creative idea?

If we refer to human experience, we know that all the external forms, moral, social, political and physical, with which man has surrounded himself, are but the realization of pre-existing and immaterial ideas produced in his intellect. The immaterial idea, has been the creating power of his civilization, his arts, his science, his philosophy. We should infer, from this experience, that, wherever a form exists, it has been worked out after a type, by the forces of nature, directed and controlled by a creative idea. But where exists this idea of organic forms? Is the vital force an unconscious intelligence, as the mind is a conscious intelligence? Does it possess, as is maintained by Carus, Klencke and others of the German physiologists, "a vital idea," which, "without consciousness unfolds the living members from the germ." Or is it not rather to be found in the creative idea of the Supreme and Omnipresent God, reproducing through the medium of the forces of nature, the forms first called into existence, at the epoch of creation? These are questions of abstract metaphysics and of religion, which it is not to our taste, nor our duty, nor would be useful to enter upon.

The vital or organic force, and the proper vital or organizing actions, I regard as strictly limited to the formation of the tissues and organs. They are the constructors of the economy. The seat of the vital force and vital actions, is consequently, the primary organic cells, originally produced

from a mother cell, that must be traced back to the first origin of things, as they are not seen to be created of themselves—ab ipsis.

This force and these actions, are liable to be disturbed in their mode of existence, in the regular play of their operations, by external agents and by internal derangements; and thus are presented as a base of numerous pathological conditions. It is to them, that are to be referred, inflammation, congestion, fever in part of its phenomena, the various alterations of structure, as induration, softening, hypertrophy, atrophy, metamorphosis of structure.

The vital force and actions, seated in the intimate primary structure, the organic cells, can rarely be affected, except by direct influences. They can be reached only through the blood and the circulation. The blood is the immediate stimulus, assimilated by the vital force and actions, between which and the forces of the organic cells, vital reaction is maintained. Alterations in the constitution of the blood, foreign matters carried into the circulation, retained and and depraved secretions and excretions, are for the most part, the disturbing causes of the vital actions.

II. The second class of phenomena, are the dynamic, or those that are produced by the nervous forces and actions of the cerebro spinal-axis. The German and French physiologists, almost without an exception, regard the nervous forces and vital force, as identical. I have never been able to find the evidence of this doctrine. The independent character of the two, an opinion I have always held and taught, I am gratified to find, is advocated by Mr. Carpenter, and Marshall Hall, two of the ablest physiologists of England, and ranking with the highest in Europe.

If the assumption were correct, that nerve power and vital, or organic force, are the same, then, it must follow, that the plasma or organizable substance, and the primitive or germinal spot of an ovum, are nervous substance. No proof of this is attempted; the reverse is apparent. But

Oken boldly makes the assertion, that the plastic matter "is the true nervous substance;" he unhesitatingly affirms that, wherever there is life, in vegetables or animals, though nervous matter cannot be discovered, that it must exist, fused, disseminated as an element in the general structure, not yet separated into a tissue or organs. Carus adopts and defends the hypothesis—Klencke, one of the latest writers of this school, asserts the same doctrine. "The origin of the animal," he says, "is from nerve, and all anatomical systems are only unwindings, or expansions from the nervous mass. The animal is nothing but nerve; and what is further, is nerve metamorphosis."

These are gratuitous assertions; they are forced and violent explanations, rendered necessary by the general hypothesis these writers have assumed, that nerve-power and life are one and the same thing.

The essential character of the vital force and actions consists in their being formative. They build up and construct the organs, the instruments of functions. They are limited to the modifications and combinations of the elementary chemical equivalents of the organic substance, and of organic molecules: they cannot act on and move masses. But animals are endowed with surprising powers of locomotion and great physical power; and many internal functions are dependant on physical movements. Other forces and actions, then, are called into operation for those purposes. They are the dynamic phenomena of the nervous system, those of the cerebro-spinal axis in particular.

The physical movements of the economy are accomplished by contractile, or muscular organs, variously arranged and disposed. They do not act of themselves, but their contractility is always excited into action by the nerve-power of the cerebro-spinal axis—motor power of Marshall Hall. The immediate agents of this power are numerous centres from which conducting nerves convey the nerve-power of the centres to the moving organs.

This motor power of the nervous centres is excited into action in various manners. 1st. By the intellectual acts called volition, in what are named the voluntary motions. 2d. By impressions unattended with consciousness, made on internal or external surfaces, transmitted to the nerve-centres by appropriate nerves,—incident and excitor nerves,—producing reflex actions, or the involuntary actions. 3d. By impressions of which we are conscious, or by the sensations. All the organic functions, requiring for their performance sensible movements, as well as the locomotive functions, are immediately depending on the nerve-power—the dynamic functions of the cerebro-spinal axis. Respiration executed by the action of the diaphragm, abdominal and thoracic muscles; the circulation sustained by the impulsive motions of the heart; the various alimentary functions of the primæ viæ, for all which, different contractile movements are required; the transmission of the secreted fluids from their glands and reservoirs along their ducts; in fact, all physical movements, of whatever kind, occurring in the animal economy, are excited into action by the motor power of the cerebro-spinal axis.

In health or in disease, the movements of the economy are the reflection of the condition of this nerve-power. The tone of the organs, the force or the weakness, the regularity or irregularity of their movements, are the direct results of the greater or less development, activity and harmonious action of the motor power of this apparatus.

The continuance of life is, consequently, placed in dependancy on the continued exercise of this force. The conditions indispensable to the play of the vital force and the vital actions, a constant renewal and supply to every portion of the intimate structure of the organizable plasma charged with oxygen and defecated of impurities—are accomplished by organs, whose actions are excited and sustained by it.

While the vital force and actions are thus in virtual de-

pendence on the cerebro-spinal power, that force is not less intimately linked to the conditions of the vital force and actions. They control, as the fabricators of the nerve structure and nervous organs—the generators of nerve-power—its conditions of force, activity and regular operation.

The indissoluble alliance and mutual dependency of the two forces and classes of phenomena, rendered difficult the drawing of the line of discrimination between them. The progress of microscopic and genetic anatomy, and of experimental physiology, has made the analysis and separation of them an easier task.

Barthez, long since, observed and announced the distinction I have now drawn. He divided the forces into two classes. The first he named the radical force of life. It is our vital or organic force. The second he termed the acting forces of life, from which movements resulted. They are the dynamic actions, the motor and excito-motor force of the cerebro-spinal axis. Barthez was unable to exhibit anatomical or physiological proofs of his views; he could not locate and specialize the seats and organs of his forces. His doctrine did not take root, but now reappears as the expression of a great truth, growing out of modern investigation.

The dynamic or nervous actions of the cerebro-spinal axis are exposed to be disturbed by numerous causes, internal and external. Their disorders may occur alone, as in the pure neuroses, or may be associated with almost every disease to which the economy is obnoxious. The numerous anomalies, irregular symptoms, Protean forms, assumed by so large a portion of diseases, that embarrass, perplex, and often confound the most experienced practitioner, most generally proceed from the irregular action of this force, in some one or more of its numerous centres. A familiarity with this class of phenomena, and an acquaintance with the apparatus of these acting forces of life, con-

sisting of numerous independent, but confederated centres of power, moving, controlling, exciting, presiding over separate organs, apparatus of organs, portions and zones of the animal organism, will enable you to recognise them at sight, to estimate their value, often to determine the mode of their origin, and location of the disturbed centre whence they emanate. This knowledge, to the pathologist and practitioner, is a safe guide when surrounded by difficulties unknown from his former experience.

It is a favourite hypothesis with some physiologists, that nerve-power and galvanism are the same. Experiments have been repeatedly made to confirm this opinion. A certain degree of analogy between some of their phenomena and laws of action, has been shown to exist; but their identity has not been proved.

III. The third class of the actions of the living organism are its chemical actions.

With not a few, chemistry is outlawed from the domain of vitality. Because the chemical phenomena of living beings, are not the chemical actions of inorganic bodies; because the chemical processes of the living organism, cannot be imitated in the processes of our laboratories, they are denied to be of a chemical nature. If combinations of chemical elements and new arrangments of chemical equivalents; if the changes of component atoms, productive of new forms and new properties, be chemical, and I know not what other is chemistry, then, the great organic functions, respiration, digestion, secretion, nutrition, must be essentially chemical actions, regulated and determined by the laws of vitality.

The two proximate facts of vital activity, persisting from the first to the last movements of life; that follow them through all their grades and modifications, indicating their force and condition, are the combination of the oxygen of the atmosphere with the carbon of the organic matter, and the consequent developement of temperature. Surely, if

any phenomena can be regarded as chemical, these must belong to that class of facts.

A stronger illustration is presented in the development of the chick in the egg. Albumen, some animal oil, and a microscopic germinal spot or vesicle, are the contents of the egg. During incubation there is no addition but oxygen from the atmosphere; nothing is given off but carbon. Yet there is formed, by the vital chemistry of this organic laboratory, blood, membrane, muscle, nerve, glands, secretions, bone, feathers, horny substance. The chemical elements, and, as respects the most important tissues, the chemical equivalents of the original albumen, the organizable substance, are precisely the same, as the chemical elements and chemical equivalents of these varied and dissimilar organized structures. The only modification has been a new arrangement of the chemical equivalents of the albumen, or the loss of some atoms of its carbon, and addition to it of some atoms of oxygen. Here is presented the strongest evidence of chemical actions.

Chemical actions are, however, but a part, a very subordinate part, of the important phenomena of vitality. The creative force of life has used chemical laws for the composition of the materials it employs, in the production of forms, the construction of its instruments, or organs, and the creation of a living being, after especial types. Chemical actions are means to produce an end: they are agents, assisting in the organization of living tissues, but can never of themselves produce organization, not even of the simplest structure.

Not less striking is the evidence furnished by the successive transformation of the aliment, vegetable and animal, into chyme, chyle and blood. The chimical equivalents, of those different substances are the same as to number and weight. Yet how different are these substances, in all their properties. The blood, the organic fluid, is transformed into solids, muscle or flesh, and nerve substance.

But no change in the chemical elements, or equivalents has been necessary. The chemical equivalents of muscle, are precisely the same, as to number and weight, as those of the aliment, animal food and nitrogenized vegetables. Little as these various substances resemble one another, there has not been the addition, or the loss of an atom. The only change has been in the arrangement of their chemical equivalents, and this has been sufficient to produce new forms, new states, new properties.

But the solids are not fixed. They are consumed and disappear in the actions of vitality, to be reformed from the plasma of the blood. Yet we do not find the organic matter of the solids escaping. No albumen, or fibrin, or proteine, or gelatin, are found in the excretions. What then is the mode of their elimination? The chemical elements of the organic matter, enter into new combinations, form new substances, new products, that are found in the excretions, principally the urine and the bile. The excretions and the secretions together, give the chemical equivalents of the blood and the solids.

Here are all the evidences of chemical actions. It is true, they surpass all that chemists can, or ever will accomplish. But they are not the less chemical actions. They are appointed to be executed by the living laboratory of organic beings, constructed by the Supreme Artificer of the Universe. The clumsy contrivances of man, never can pretend to imitate processes of such surpassing delicacy.

There is, then, a chemistry of living beings, intimately associated with their vital actions, and necessary to their completion. The chemical actions of life, form the materials, the immediate organic elements, used by the creative force of life, in the construction of the living organism.

Organic chemistry has not, as yet, been an available source of accurate knowledge, applicable to our science. Chemistry had not, until a recent period, reached the height where organic chemistry begins. But organic chemistry has now

acquired development and activity. It has taken its position as a department of the physiological sciences, which must depend upon its future movements, so closely are they interwoven, for their progressive advancement. It cannot be neglected without the danger of a charge of culpable ignorance. Organic chemistry has driven a shaft into the depths of organic phenomena, and struck on a rich vein. No one can foresee the importance of the facts it will bring into light, or the changes it may effect. The recent work of Justus Leibig, is the first successful effort in this unexplored department of medical science. It is to be regretted that he has not confined himself to the experimental part of his investigations, and has, prematurely indulged in speculation, for which the science is not sufficiently ripe. What he has done is a promise of the rich stores that will be poured out from the exploration of this vein of knowledge. The most skeptical must be startled at the facts, unquestionably established, and the views they open in the vista of our science.

It cannot be doubted, that organic chemistry is the most important of the means that can impart clear, defined, precise ideas of the processes of the organic functions, in health, in disease, and under medicinal influence. When in possession of this positive knowledge, instead of the notions, it must be confessed, too frequently loose and uncertain that now prevail, it is not possible to anticipate the suggestions it will awaken in intelligent minds, as to the means of preserving health, and the remedial agencies adapted to resist and overcome disease.

But let not the pretensions of organic chemistry be carried too far. It can never be looked to, as a basis for the science of medicine, or for more than a partial theory. The limit of its usefulness, is the exposition of the chemical side of the facts of the organic functions, in their natural state and in disease.

IV. The fourth class of the phenomena of living beings belong to mechanics. The animal organism is the most

finished of machinery; it is moved by mechanical forces, and mechanical principles are applicable to many of its phenomena.

I can barely touch on this subject; a volume would be required to exhaust it. The skeleton and the muscular system exhibit the animal mechanical powers in their greatest development. They are the most perfect system of leverage that exists. The hand is especially the master-contrivance of mechanic skill. In accidental derangements and diseases of the osseous apparatus, disabling its uses, a knowledge of mechanics is a most efficient aid to the surgeon. I cannot avoid citing, as an exemplification of this remark, the simple but ingenious operation originally devised by Dr. John Rhea Barton, one of the most eminent surgeons of this city, for the relieving of ankylosis of the larger joints. The operation has been successfully performed by himself, and by Professor Gibson.

No hydraulic machinery can compare with that of the circulatory apparatus. It immeasurably surpasses the most complete human invention. The heart, a forcing and sucking pump, has its moving power innate in its walls, adapting it to its contents, and regulating the velocity and force of the sanguine current, according to the varying exigencies and conditions of the economy with which it is placed in synergic connexion.

The arteries are hydraulic tubes, endowed with vital elasticity, reacting on their contents, driven into them by the heart's impulse, with the same degree of force, and, consequently, extending the action of the heart to the extremities of the arterial system. In the heart and arteries, the mechanical powers are predominant, the vital forces are inferior; in the capillaries, the physical powers are at zero, the vital forces and actions at their highest point.

In the venous circulation, the physical action of the heart, atmospheric pressure, muscular contractions are the

mechanical influences that are brought into play for its maintenance. The laws of hydraulics are fully applicable to the circulation of the blood. The fact is demonstrated in the experiments of Hales, and confirmed by those of Magendie and Poiseulle.

Gravity exercises a decided influence on the circulation. It may be accelerated or reduced by position. Its movement as shewn by the pulse, is slowest in the recumbent posture ; it is more frequent sitting, and still more frequent when standing. Advantage is taken of the influence of gravity, in the treatment of disease. By regulating the position of the whole body, or of some limb, increasing or diminishing the velocity, or the amount of the circulation, the vital condition, depending on the supply of the vital stimulus—the blood, may be substantially qualified.

Respiration is a function largely depending on physical powers. The enlargement and contraction of the chest are effected by muscles, the instruments of physical power in the economy.

The air is forced by its own expansive power into the lungs, through the air passages, as the thoracic walls, expand. The exercise of this function must correspond with the physical powers. I have known pulmonary disease to be suspected in patients, for no other reason, than an inability for prolonged exertion of the voice, and a hurried respiration from active exercise. The cause of those symptoms was exhaustion of the physical powers, and consequent failure in the mechanical part of the respiratory acts.

The want of tone in the muscular system, enfeebles all the mechanical actions of the economy. This is remarkably shown in its influence on the contents of the abdominal cavity. When the walls of the abdomen become enfeebled and relaxed, the included viscera lose their principal support. The large mass of the small intestines fixed by the short attachment of the mesentery to the back, sink into the

pelvis; the arch of the colon, the stomach, the heavy mass of the liver follow. Hence proceeds that painful sense of vacuity, felt in the upper region of the abdomen, the sense of weight and dragging in the lower portion; pain in the back; derangement of the digestive, alvine and uterine functions; and difficulty of being erect or of walking. These inconveniencies and sufferings are often abated very materially, sometimes entirely relieved, by mechanical contrivances, substituting artificial for the natural support.

It is unnecessary to enter into fuller detail to prove the existence of mechanical actions, and the operation of mechanical laws, as intimately associated with the phenomena of the living and acting organism of man.

V. The last class we have to bring to your notice, are the Psycological Phenomena. A mere passing notice can alone be bestowed on them at this time. They are the manifestations of the intellectual principle, that in man reaches the largest extension of power, and most perfect condition of activity of which it is capable in our sphere of existence. These phenomena consist of sensibility, of consciousness, of ideas, of the understanding, of the will, of instinctive affections and moral sentiments.

This principle can manifest its existence only in connexion with a material substratum. Its organ is the external convoluted membrane of the cerebral hemispheres. By this indispensable association with the material organism, the intellectual and moral faculties exercise a vast influence over the organic functions, and, in turn, are influenced again by them. Hence the frequency of the complications of disordered cerebral functions, delirium, phrenzy, stupor, hallucinations of senses, insanity, arising from bodily ailments. Hence, too, the number of functional and organic diseases, in advanced civilization, depending on the moral cares, the harrassments of life, the working of the

passions, the loss of hope, the physical depression from mental despondency.

In critical moments of acute diseases, the state of mind of the patient often inclines the balance towards recovery, or a fatal result. I lost a patient, who, while convalescent from an attack of fever, and sitting up, received a violent mental shock by the sudden communication to him of a protest of a note in bank that had been neglected. He survived the shock but three days.

The preceding observations embrace a summary of the different classes to which the phenomena of the living organism, in action, may be referred. Man, in truth, may be called a microcosm, or little world.

It is the object of this course of lectures to enter into the investigation of these numerous and diversified phenomena in their different relations and connexions, in health and disease. We shall endeavour to perform the duty assigned to us, as far as the limited time allotted to courses of Medical instruction, in the curricula of the schools of this country, will permit.

I have only again to repeat, that the more clear and distinct the ideas you form of the actions of the living economy, in their proper characters, and of the class to which each belongs, the more confidence you will feel in the correctness of your views and the soundness of your judgments; the more certainty and success will attend your practical skill in devising the means for remedying their defects. The difference between one who comprehends in every aspect the phenomena he has to deal with, and one who knows them imperfectly, is the difference between the clear-sighted and the blind. We may be surprised at what the blind can do, but it is, nevertheless, the doings of the blind. Knowledge is the field of mental vision, and he who refuses to obtain the knowledge in his power, prefers darkness to light. I shall spare no labour in the performance of my duty, and shall illustrate, by numerous drawings

and tables, with which I am amply provided, the subjects that can be graphically represented. Do not you neglect your duty. Apply resolutely to the work before you, and difficulties will vanish, obstacles be overcome. Willing hearts and ready minds never fail;—they command as they merit success.