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Jackson (S)
LECTURE,

INTRODUCTORY TO A COURSE

ON THE

INSTITUTES OF MEDICINE,

IN THE

UNIVERSITY OF PENNSYLVANIA.

DELIVERED NOV. 5, 1844,

BY

SAMUEL JACKSON, M. D.

PHILADELPHIA;

KING AND BAIRD, PRINTERS, 9 GEORGE STREET.

1844.



CORRESPONDENCE.

PROF. JACKSON.—

The undersigned have been constituted the organ of the Medical Class of the University of Pennsylvania, to signify to you the great pleasure they experienced in listening to your very able and eloquent Introductory Lecture, on the 5th inst., and to solicit a copy of it for publication, believing that what afforded them so much gratification and instruction by the ear, will be more permanently and extensively useful in print.

The Committee trust you will not feel yourself at liberty to refuse the request, and beg leave to assure you of their highest regards.

Very Respectfully,

P. P. PEACE, N. C.
GROVES CALDWELL, Ala.
THOS. KING LEONARD, Fla.
J. W. HUTCHINGS, N. C.
HUGH J. DAVIS, N. C.
G. J. COLGIN, Ala.
GEORGE N. KEONEY, Va.
ROBERT M. PORTER, Tenn.
HORACE WALKER, Va.
J. J. HOOKS, N. C.
JOHN G. B. MYERS, N. C.
W. P. M'RAE, Ala.
SAMUEL D. GRICE, Va.
JESSE D. HINES, N. C.
JOHN P. BARNES, Ala.

Philadelphia, November 18th, 1844.

GENTLEMEN :—

The introductory lecture to my course of this session, which you have asked for publication, on the part of the class, is placed at your disposal. I cannot refuse the application of so large and respectable a body as the gentlemen comprising the present class, and conveyed in terms so flattering as in your note of this date.

With sentiments of respect,

Very truly, your obedient servant,

SAMUEL JACKSON.

To Messrs. P. P. PEACE, N. C.; GROVES CALDWELL, Ala.; THOS. K. LEONARD, Fla.
and others, *Committee*.

INTRODUCTORY.

Medicine was originally an empiric art. Its practice continues to the present day, to partake more or less of this character. The intention of the systematic cultivation of medicine, is to elevate it to the rank of a science, and to carry it ultimately to the height of a Philosophy. Its movement is slow : to accelerate its progress is difficult. A science whose facts are almost endless, and all of whose phenomena are compound, requiring before their truth can be known, to be decomposed and separated into their constituent phenomena, must necessarily be of slow growth. An indefinite period must elapse before its completion can be looked for. Medicine, it is probable, will be amongst the last completed of the splendid galaxy of sciences, created by the intellectual power of man.

The false is the bar that arrests the advance of knowledge. While it exists, there may be movement, but progression is impossible. The commencement of knowledge is always with the false. Knowledge is not a revelation to man : truth is not the fruit of inspiration. Everywhere the false surrounds us, is forced on us ; it rises to meet us, it is the outward aspect of things. Truth is ever concealed ; it lies beneath the surface, must be sought for, and is obtained by perseverance, labour and research. Ages passed away before truth began to spread its rays amid the dark mass of primeval error ; and ages must yet pass before the mass of error that shadows and perverts human knowledge, will be dispersed. But what is truth ? Pilate asked Jesus this question when the Son of Man was arraigned before his tribunal. " What is truth ? " It received no answer then. Has it been answered since ?

It may not be inappropriate to point out in this place, why truth should be thus inaccessible, is so rarely to be met with, while error and the false are the common current of our actual knowledge.

The mind in which truth dwells, acquires knowledge only through the senses. It is abstracted from the outer and grosser world with which it is incapable of any direct relation. The senses are the media establishing the communication between the intellectual faculties enshrined in the interior recesses of the brain, and the exterior world. Without the senses the human intellect lies dormant and inactive. It gives no sign. Each sense endowed with its especial attributes, is placed in direct relation with external matter in some of its especial qualities. The one acts on the other, and an especial sensation is produced according to the sense acted on—as sight for the eye, and hearing for the ear. The senses in their operations are merely passive agents. They translate and report to the intellect, the phenomenal qualities they discover in the things of the outer material world. But the senses are limited: they penetrate neither deep nor far. They are restricted to gross external obvious appearances. Their testimony is correct as far as it goes, but it is partial; it is not the whole truth; there is, as it were, suppression of truth, and the intellect is liable to be deceived by the fallacies of the senses. What fact is more positive to the sense than the rising and the setting of the sun? What more false in reality?

The earth to the sense is a plane around which the heavenly bodies move. It was the doctrine of the ancients; is the language of scripture; is the belief of the ignorant now. The sphericity of the earth is a philosophical theory. It cannot be known by the senses. It is evolved by the intellect from the combination and analysis of a number of dissimilar facts.

The mind soon becomes conscious of these defects. The senses do not agree in their statements on the same subject. The sight and touch, for instance, are discordant as to the distance and size of objects. The intelligence by its own operations forms its ideas of external things by comparing, combining, reflecting on the primary perceptions produced by the immediate action of the senses. The defective power of the senses is supplied by the invention of instruments—new organs—of the mind's creation, giving to it the utmost scope of perceptive power. A microscopic eye, as of an insect,

narrowing the field of vision, brings into view the primary organic forms, which matter is capable of assuming. Another eye expanding the field of vision, ranges through the immensity of space, fathoms the heavens and reveals to the astonished and overwhelmed intellect, the existence of myriads of worlds, comets, planets and suns, beyond which lie countless myriads of worlds, until this globe of ours and the planetary system to which it belongs, appear as mere atoms in the infinite universe of God.

The truth in its fulness can never be known from the senses. They quicken the mind to action, and give to it the materials for thought. Truth belongs to the intellect. There is truth in facts, but the mind must discover it. The fact alone, without mental scrutiny, is of little value. Science is filled with false facts.

Simple truths are the perception of direct impressions made on the senses relating to some external property of bodies, as of colours, sound, forms—or instinctive mental perceptions, as, the whole is more than a part; the whole is twice the half; that two parallel straight lines can never meet, and other self-evident axioms. But the truth of complex facts and phenomena is a discovery, by a laboured mental induction and reasoning process, of a general relation, running through and governing a number of dissimilar facts, blending them into one general fact, and fusing them into a common phenomenon. For the complete discovery of a truth, all the facts it governs, or to which it has relation, must be first known. The induction may otherwise be erroneous, the truth be concealed, or imperfectly perceived, as objects looming dimly in a mist.

Herein, then, is seen the inherent difficulties of truth. 1st. The senses deceive as to the truth of things; they present appearances, not realities. 2d. The knowledge that contains the truth is acquired slowly, and after long labour and research. 3d. To extract truth from the facts in which it is enclosed, requires a mind at once capacious, vigorous, largely endowed and abundantly stored. Few minds have the power, and numbers want the information necessary for the discovery of truth: many minds are not qualified to receive great truths when they are discovered.

The above difficulties are inherent in the nature of truth. There are others extraneous, not less adverse to its discovery and establishment, by which error is built up, propagated, and sustained. It

may be well to mention some of the most prominent. Amongst them are false authorities. A great reputation established in one department of knowledge, is sometimes quoted as an authority for the truths of facts or opinions in another department. A western author lately cited an eminent surgeon as an authority to disprove the existence of chemical phenomena in the animal economy. On a surgical question, there could have been no better authority, but of what value could be the opinion of one who was ignorant of the simplest laws of chemistry, and to whom a chemical formula was an enigma, on a purely chemical fact. To the same head belongs the authoritative decision of the truth of facts, or opinions on subjects never investigated, scarcely known, or at best superficially examined, by those whose names with the many pass as authority, from general reputation for ability and attainments.

Practitioners of medicine, who may be authorities, respecting practical facts, with which they are conversant, condemn the researches of minute anatomy and the labour of the organic chemist as useless, though they have never paid the slightest attention to these investigations, and cannot comprehend their bearing on the principles of medical science.

Divines and lawyers are often very authoritative in deciding on medical facts, and determine without difficulty the correctness of medical doctrines, though, from their profound knowledge and great learning, theology is far from being a settled science, or the law from having lost any of its glorious uncertainty.

But the most common causes that maintain the ascendancy of the false, and oppose the greatest difficulties to the advancement of truth, are the vices of the human character. The passions disturb the operations of the intellect and seduce it from just decisions—love of power, self-interest, sordid avarice, vanity, bigoted opinions, strong prejudices and narrow views, occasion facts to be falsified, truth to be resisted, and the false sustained. Every truth must battle its way through opposing hosts, and often through many generations, before it is adopted into the general code of admitted beliefs. And woe to him whose mission, in this world it is, to lead the van in this strife! It was for this that Christ died on the cross, a bigoted priesthood and fanatic populace crying out, “crucify him, crucify him!” It was for this that Socrates drank the cup of hemlock

doomed to death by the verdict of a factious and ignorant people : it was for this that Galileo, persecuted and imprisoned, was compelled to recant the truth of his great discovery : it was for this that Harvey, disheartened by the violence and scandal of opposition, abandoned his profession and in retirement sought to escape the malice of his enemies. Thousands of less noble names, have, like them, been persecuted for truth's sake, like them have suffered and perished. When such are the difficulties amidst which truth is envolved, and knowledge has to pursue its way, it is not surprising that medicine, though cultivated through so long a period, is incomplete as a science. No other department occupies so large a field : in no other are the facts so numerous, dissimilar in nature, complicated in relations and combinations, difficult to verify, and requiring so much knowledge to be understood.

No science is accomplished until its primary facts or fundamental truths have been ascertained. Every science consists of a succession of phenomena, proceeding in regular gradation and in close connexion from a primary or original fact, the expression of a primary law. They are the bounds that limit human knowledge. While primary or fundamental facts are unknown, the series of facts, which, in their connexion with each other, and the order of their succession, form the positive laws of science, must be incomplete, and are deficient in certainty.

Fundamental facts are never discovered in the first periods of the cultivation of science. They are amongst the last that become known. Disjointed portions of a series of facts are ascertained ; these are taken for laws, and lead to erroneous conclusions.

The absence of a connecting fact in a series must distort the truth ; and the substitution of a conjecture for a fact, more certainly introduces error. Gradually the continued labour of observers and experimenters, supply the defective links ; positive facts take the place of hypotheses ; knowledge becomes more perfect, and when the last of the series is reached, the law governing all the facts that enter into it is completed. Each law, thus determined, is the expression of a general fact or truth. It is a principle in science.

The discovery of the primary fundamental facts, or laws of life, have been slow and difficult. It strikes me, however, that this point has been reached, and that the fundamental facts, or primary

aws of physiological science, if not fully ascertained, are approached so closely, that little remains to be revealed.

That organization is inseparably connected with vital activity, has long been recognized as a fundamental fact, or primary law of life. But, the special laws of that connexion, the detail of its facts, the processes of organization were concealed.

The discoveries of Schleiden and Schwan confirmed and extended by Valentine, Henlè, Müller, Wagner, Martin Barry, Bowman, in short, by all modern physiological observers, has made this law definite, by revealing the first processes and various manifestations of organization.

The following may be regarded as primary and fundamental laws and facts of organic life.

I. The indispensable conditions essential to organization are, the combined action of, 1st, a vital or organizing force or power, its nature unknown, but its existence revealed by its relations to organic matter, and manifested exclusively in the organic forms it creates.

2d. A Plasma or organizable material from which organized beings are produced.

3d. Caloric, the excitor power indispensable to vital action; and,

4th. Oxygen of the atmospheric air, a chemical decomposing agent. The presence and united influence of all and each of these agents, are indispensable requisites for exciting and maintaining the play of the primary organic actions, and the production of organic forms. No vital movement or act of life, or organic formation, can occur, or continue in the absence of any one of them.

II. The first evidence of organization is the appearance in the plasma, or organizable material of minute granules, which soon aggregate so as to form larger masses, by physiologists called nucleoli and nuclei, or corpuscles. From these are developed organic fibres, lamina, and organic cells containing within their interior, or in their walls the primary nuclei and nucleoli. Each cell and corpuscle is a living organism, analogous in its vital attributes to the simplest forms of vegetables and animals. It imbibes, or is penetrated by the surrounding plasma that serves for its nutriment, acts on, modifies and metamorphoses it, appropriates what is fitted to its own particular nature; and rejects what is not adapted to its function or structure as excrementitious. It passes through

periods which are its ages, undergoes metamorphoses or changes, wastes, decays, becomes effete, dies, and is ejected along with its contents and more or less changed in form and composition, as an excretion.

III. The organic cells and primary corpuscles, are the seats of the organic or vital actions of nutrition and secretion. These have been heretofore conjecturally attributed to some vague undefined action of the capillary vessels. Nutrition or assimilation, and secretion, are cell functions in the physiological state, as irritation, inflammation, congestion, morbid productions and changes of structure, are for the pathological state. The capillary circulation is provided, has for its object to bring to the organic cells the organizable material impregnated with oxygen, and to place it in relation with them.

IV. The different tissues and organs are aggregations of organic cells, corpuscles, or fibres, either as primarily developed, or in secondary forms, changed by metamorphosis.

The mode and degree of vital activity of each tissue and organ, is but the aggregate of the degree and mode of vitality of each component cell, corpuscle, or fibre. The phenomena and history of one cell, or organic atom, are the phenomena and history of the whole tissue and organ, as those of the tissues and organs are of the whole economy of man.

V. The phenomena accompanying the vital or organic actions, are the consumption of oxygen, the production of carbonic acid gas, and evolution of heat. There is no instant of life from the first commencement of the germination of the seed, or the hatching of the ovum, when these phenomena do not occur. There is a uniform proportion between the force of life; the activity of the vital or organic actions, and the quantity of oxygen that disappears, of carbonic acid generated and heat evolved. The one may be taken as the measure of the other.

As the combination of oxygen and carbon and evolution of heat are and can be regarded as no other than purely chemical actions; as the oxygen is furnished by the atmosphere, and the carbon can come from no other source but the organic material of which it is a known element, and increased temperature is a known result of the chemical union of oxygen and carbon, it is obvious that every vital

or organic action, every act of organization, is accompanied by a chemical action. In other words, chemical action is an inseparable part and parcel of every vital organic phenomenon. There is, therefore, a chemistry that belongs to life. It is what is named vital or organic chemistry.

The foregoing are the fundamental facts of organic or vegetative life, or that series of vital operations by which the plasma or organizable material is variously modified, and by which blood, tissues, organs and an organized being are evolved as products from it. These are established facts of the science, sustained by concurrent positive observations of the highest authorities in Germany, France, and England. I do not think a single proposition can be gainsaid.

Every theory, every explanation, all reasoning on phenomena connected with vital or organic actions, with the organic structure and its functions, in their physiological or their pathological states, must take these facts as their point of departure ; they must include these facts within them, or it is scarcely possible they can be correct.

The preceding are the fundamental facts of organic or formative life exclusively. The phenomena of animal life, manifested in the nervous organism, belong to another category, and are not embraced in the present investigation. They are sensibility, general and specific ; excitor and motor power, producing involuntary and instinctive muscular actions, from which proceed all the physical actions of the economy ; and lastly, the psychological phenomena, or those of the understanding, will, and moral affections. These are manifestations either of different forces or specific modifications of a same force in the different apparatus of nervous organs. Animals alone possess them ; vegetables give no evidence of their existence. They belong to the nervous apparatus, or nervous organism, as it may truly be called, in all animals it is most probable ; certainly in all above the class of acrita. These phenomena are characteristic of the action of forces, having no analogy with chemical forces affecting the chemical constitution and arrangement of the atoms of organic matter. Nor can they be regarded as identical with the primary force of life—the organizing principle. This force, as we shall immediately show, is the creator of organic forms ; it produces the nerve substance, and builds up the complicated nervous organism

in which the nervous forces are generated, or made manifest. It must, therefore, precede the appearance of a nervous system, and the existence of the nervous powers.

The facts that have been brought to your notice, enter into the primary law of organic life, and are a portion of its fundamental facts. Organic chemical actions compound from the crude plasma the materials of organized structure; the vital force creates from these materials, especial organs; and an individual, with its generic and special form, characters and endowments, is produced.

There is another series of organic phenomena depending immediately on the primary force or law of life, to which I now wish to call your attention. They are the production from formless materials of the invariable generic and specific forms, of every tissue, organ and being of the organic kingdom. The primary law of life thus includes a law of the type of organic forms. Though very little attention has been paid by physiologists to these phenomena and this law, in their connexion with medicine, they are of the deepest interest. They merit an attentive consideration. Presiding over and executing the acts of organization, not only in the primary development, but in the constant reproduction of the tissues and organs during life, there can be no pathological or therapeutic doctrine, entitled to confidence, of which they are not a principal element. They are the point of departure for the theory and practice of medicine when framed on the facts and laws of life, ascertained by investigating and analysing all the phenomena of organized beings, and not limited to a single class of facts.

The importance of the recognition of this law, and the phenomena the direct result of its action, appears to me to possess so important a bearing on the practice of medicine, that I have been induced to select the investigation of them, as the most appropriate subject for a discourse introductory to the Institutes of Medicine, or General Physiology and Pathology. I shall now proceed to demonstrate their existence, to point out the speciality of their character, and to show that, constituting the medicine of nature, they should form the basis of artificial medicine. Artificial therapeutics are but imitations of the therapeutics of nature.

Every living being is a mechanism composed of numerous organs

and apparatus or combination of organs, executing a special function, or functions, necessary for its individual existence.

Every organ is an instrument, a machine contrived for a particular purpose, and is constructed on a specific plan. In no being are two organs the same. Each organ has its special organization as to tissue and as to form. No one organ can execute the office of another; each function necessitates a distinct organ, a particular mode of organization, an appropriate instrument.

In the same species of vegetables and animals, the individuals are exact repetitions of each other, in their organs, functions, forms, and in every particularity however trifling or minute. In vegetables and animals of different species it is otherwise. The organs, though exercising similar functions, differ in form and arrangement. The stomach, or heart, or lung, or brain, or eye, or any other organ, differs in every species. No two are the same. Each organ and individual, no matter how insignificant it may appear, is the perfect adaptation of means to an end. This law, it cannot be doubted, has prevailed from the first period of creation.

This is the history of the organs in the finished machinery of the organism. But the first period of every organized being is a kind of organic chaos, and, as it respects its organs, formless.

The organs have no existence in the seed or ovum. They are not found in the first periods of the embryo. They are gradually developed in a fixed succession to each other from the plasma or organizable substance, itself without form. In addition then to the primary organic actions, the organic chemistry of life, by which are manufactured the organic materials, as albumen, fibrine, cerebrine, neurine, chondrine, there is another class of actions, by which those materials are wrought into the forms of the specific tissues and organs of living beings. By this series of actions is filled up and executed a complicated plan of organization. It combines in varying proportions the organic matter, arranging it into endless forms, perfecting numerous instruments, and realizing in each organ and being a type, that never varies through endless generations.

These facts are demonstrated by the study of embryology. The development of the tissues and organs can be observed in the ova of different animals and insects from minute to minute, and from stage

to stage of development. The movement of organization can be followed out with great precision. The creation of the tissues, the organs and a living being is witnessed. For the details of this interesting study, I must refer you to the works of Wagner, Burdach, Baër, Bowman and Todd, Jones, and Martin Barry's papers in the Philosophical Transactions. My purpose will be answered by presenting the bare outline.

We have an egg. We know perfectly its contents. They are the yellow, composed of albumen, animal oil, sulphur, phosphorus, some iron: and of the white, consisting of albumen, some alkaline and earthy salts. These constitute the organizable matter, plasma, or embryotrophe. There is further a cicatricula, or a minute vesicle and a germinating point. These are the contents of the egg. They are the constituents, from and out of which, the blood, fluids, solids, tissues, organs, and a living being are created.

The exterior agents that participate in the process of hatching the egg, are equally well known. They are a temperature of 100° F. and atmospheric air.

If the egg be unfecundated, or causes have destroyed in it the fecundating influence, imparting the capacity of an individual existence, the application of the proper temperature produces, not the organizing action of life, but, as in other dead animal matter, a purely chemical action, the decomposition of putrefaction.

The animal matter with the sulphur and phosphorus, are converted into foetid gases, and escape, leaving the shell empty.

But when the fecundating influence has bestowed the capability of a distinct vital activity, the vital excitor heat produces with the vital force, organico-chemical actions in the whole organizable matter of the egg. The yellow and the white exhibit changes going on which prepare them for the metamorphoses they have to undergo. The punctum saliens, the germinating point, commences an organic development, and the liquid and formless white and yellow of the egg, are transformed into corpuscles, cells, blood, tissues, organs, and a living individual.

There escapes during this process from the egg, nothing more than carbonic acid gas: there enters into it nothing more than oxygen, and in the proportion to form the carbonic acid which has been disengaged, and no more. The oxygen, therefore, has not furnished

an atom towards the composition of the organic materials of the organs and tissues. But it must have abstracted some atoms of carbon from the albumen or organic matter to form the carbonic acid given out.

At the end of some twenty days, a horny beak from the inside, pecks a hole in the shell ; a little head with its clear eye, peers curiously out on a strange world ; with a few efforts there is disengaged from its prison a living creature, active in limbs, running in every direction, uttering its feeble cry, recognizing and obeying its mother's voice, picking up its little grains, possessing sensibility, endowed with a will, having all the attributes of a living being adapted to the part it is intended to perform in the small corner it is destined to occupy in this wide creation.

And how came it here, in this shell, this piece of life mechanism, with its curious framing of so many dissimilar parts, yet all united to form one animated perfect whole ?

We know what was in the egg. Its original contents, the white and yellow, have disappeared. They have been transformed into blood, organic cells, fibres, muscles, brain, bone, membrane, horn, feathers, organs, viscera, complicated vital instruments, each and every part necessary, essential, and precisely fitted for what it is intended to perform in this life-machine.

The operation of this law is displayed more completely, when presented in another light. An organ is an instrument. Now, the construction of an instrument requires intelligence. There must be the adaptiveness of means to an end. But for this purpose knowledge, calculation, founded on the properties and laws of bodies, are necessary. The eye is an optical, the ear an acoustic instrument. No similar inventions of man can bear comparison with them. The eye consists, without its appendages, of some twenty pieces, and the ear, of not less, each piece complete in its formation, each intended for a special object. Yet the whole are so calculated and adjusted on a perfect knowledge of the laws of light and sound, that the visual rays proceeding from objects, by the transmitting and refracting media of the eye, are made, under all the varying distances of bodies and states of light to form a perfect picture on the retina ; and by a similar perfection in the structure of the ear sonorous vibrations are concentrated on the acoustic nerve. These admirable and com-

plicated instruments are formed from the yellow and white of the egg. The interior of the egg shell is the workshop in which this work is done: heat and air are the only agents employed. What artist devises, what hands construct these wonderful organs? Who can attribute their production to any properties or forces inherent in matter?

The same truth strikes us in respect to all the organs. What mechanic can contrive a force pump like the heart, or hydraulic tubes like arteries? Organic physicks and chemistry baffle human intelligence and skill.

In this series of phenomena is shown a law of life controlling, directing and moulding the organic actions and laws, and chemical organic affinities, and executing in the most minute perfection for each separate being, a complicated plan of life mechanism, the intricate machinery of a living and acting organism.

It is evident, that the vital or organic actions exhibit two distinct series of phenomena. They should be kept separate in studying the organic actions and laws, though they do not act separately. They are in operation at the same instant of time.

This is shown in the development of the organs. The first step of the process is the formation of the common organizable material, or plasma. In this substance almost simultaneously appear granules, corpuscles, organic cells, fibres and lamina. From these are produced blood disks, vascular retes, capillaries, arteries and veins, nerve fibres and nerve substance, ducts or tubes, as they may be required; cellular, mucous, serous or other membranes, as the structure of the organ adapted to its office may render necessary; and finally complete organs arranged into a combined economy.

It is clear, that in the physiological state, the production of the organic material, and the construction of the organic form out of that material proceed *pari passu*. Both are developed and completed together. But in some pathological states, this rule is violated. The law of the organic type or form, is quiescent or inoperative, while the production of the organic substance and growth of the primary organic forms continue active, though irregular. This fact corroborates the view I have presented of the compound character of the vital actions, embracing two distinct series of actions and phenomena. Cancer growths are an evidence of this position. Müller

has shown that medullary cancer is, in its substance, and mode of growth, analogous to the spina dorsalis of the embryo. It is the first period of nerve formation. It is persistent in this state in cancer, does not pass into the full development of nerve structure; and its growth is not restrained by a type productive of organized tissue, or an organic form. There is active production of organic material from the plasma or organizable substance: there is growth and nutrition but no completion of an organic form. The product is not an organ. It grows indefinitely and destroys, often, by its mere mechanical disturbance. I have seen medullary cancer growths fill up the cavity of the abdomen, and prove fatal solely by mechanical pressure on the viscera.

Chondrinous or cartilaginous cancers present the same circumstances. They are composed of chondrine, the same as the chondrine, or first period of cartilage in the embryo. It undergoes no secondary change. Its growth is unrestrained by any law: no type is fulfilled, no organ is formed.

These instances, and others could be adduced, prove, it appears to me, the conjoint existence and action of two fundamental laws and phenomena of life.

The two are essentially different. The one exhibits the characters of chemical phenomena, and is a vital or organic chemistry. It consists in the production from a single organic substance of a number of organic materials, having the same chemical equivalents. The differences of properties and characters appear to be owing to a modification in the arrangement, or numbers of the atomic chemical equivalents: or to a slight change in the atomic elements.

The other cannot be referred to any known phenomena of physics or chemistry. It can be attributed only to an unknown, and to us incomprehensible power. Because our finite intelligence cannot understand its mode of existence, or action, we are not authorized to deny its existence. Whenever we seek to penetrate beneath the mere surface of phenomena, and to investigate their causes, we meet the incomprehensible and the mysterious. Nature is filled with miracles daily passing under our eyes. They do not surprise us, as wonderful, because they are familiar; and we suppose they are known. What is most striking in this power, is the unquestioned evidence of design, of intelligence that superintends its operation.

It creates from a single and formless substance, all organic forms, every organ of a living organism, every living being. Each form, organ and being, is adapted to a purpose which no other can supply; and each organ is prepared anterior to the exercise of its separate office, for future use. A very slight alteration in form or structure is sufficient to destroy its function, and defeat the aim of its existence. Here is evidence of the highest intelligence.

It is impossible to refer the phenomena of organic formation, as results of the action of any known, or of any conceivable properties of matter. In the face of these facts, I cannot refuse the evidence of the existence of a force independent of the plasma or organizable material, that composes from it the various organs, the perfect machinery, and the symmetrical beauty of a living being. On this subject I cannot but differ from the majority of the physiologists of the present day, who are disposed to attribute the phenomena of life, as the result of the properties of organic matter, independent of an especial vital force or principle. This view appears plausible when the animal economy is studied in its full development, and the organs are observed in the active performance of their offices. The muscular system is the most perfect mechanism for all the required mechanical actions of the economy. Nothing can be more admirable than the nervous system, the generator of the dynamic power that sets the muscular apparatus in action; that is the seat of the will that controls, and the power that co-ordinates this force, combining and harmonizing the muscular actions. The vascular system, for the due and constant supply of the blood, of plasma or organizable material, charged with caloric and air, is the perfection of hydraulics. The respiratory, digestive, and secretory apparatus are each the exact adaptation of the means for the chemical processes they execute. All the physical, dynamic, and chemical phenomena of a living organism can be understood and explained in connection with the organs, by the ordinary physical, dynamical and chemical laws. They compose automatic life.

The organic apparatus and functions have one common object; that is, to procure and maintain the indispensable conditions for the play of the vital force, and the organic actions depending on it.

These purposes they are adequate to and do execute with admirable precision, under the laws governing common material

phenomena. But none of them alone, or in combination, can give as a result the construction of an organ, even of the simplest form. It is absurd to suppose that the laws whose actions consist in modifying the atomic proportions and arrangement of the chemical elements of the organizable matter, its supply and distribution can, by any possibility, construct a complicated instrument. Neither can it be admitted that organic matter, or that protein, or albumen, the primary organizable substance of animal tissues, can possess, as an innate property, the power of assuming, when subjected to the action of caloric and oxygen, especial organic forms, varying in each separate species, according to the external relations of that species.

It would be as rational to suppose that an instrument, or a machine, a telescope, a microscope, a watch, or steam engine, could be constructed by innate forces, laws, or properties of inorganic matter, as that the dioptrical instrument, the eye, the acoustic instrument, the ear, the hydraulic apparatus of the vascular system, the symmetrical arrangement and diversified construction of the nervous system, or the admirable mechanical apparatus of the muscular system, in which is solved the problem of attaining the highest sum of power with most compactness and greatest symmetry of form, as that all or any one of these could be formed by any possible innate property, law, or force of organic matter.

The conjecture that an instrument, or a mechanism, because it is composed of organic and living matter, can construct itself, or that it can be produced from any possible action of any property of its materials, is contrary to all analogy, and opposed to all experience.

If a piece of mechanism, an instrument, or any contrivance is met with, though its construction be unknown, no one doubts that it is the work of an intelligent being; and further, that it must have existed as an ideal form, in an intelligent mind, before it could have acquired a material form.

If we would seek to inquire deeper into the nature of these phenomena, and the law that governs their production, it would be a vain effort. We have reached the limit of human research; we touch the vail that hides the infinite from the finite, not to be raised by human hands.

There is but one conclusion that can be adopted. The ideal

plan of the universe, in the minute as in the vast, for each individual as for the whole, must have pre-existed to the creation in the Supreme Eternal Mind. The creative idea of the ever present, all-pervading intelligence of God, continues to re-produce and to maintain in existence all created forms, after their original types, by the instrumentality of the forces, which God has spread throughout nature.

Something of this idea is contained in the terse but quaint lines of the religious poet, Quarles, in an ode on the organ—

“Man is an organ ; to whose every action
Heaven gives a breath (a breath without coaction),
Without which blast, we cannot act at all ;
Without which breath, the universe must fall
To the first nothing it was made of ; seeing
In him we move, we live, we have our being.”

An imperfect exposition of this law may be found in the phenomena of our own intelligence. We are conscious of the actions of the understanding. We have the perception of trains of thought, of our conceptions, of images, of ideas.

The mind invents, it creates. We are equally conscious of the action of our will, which controls the dynamic force—the motor power producing physical efforts by the muscular system, through which we operate on external things, and embody in them the ideal of the mind. The idea of the understanding thus creates a reality in a material form.

The sculptor models in clay and chisels from the block of marble, the forms of beauty, grace and truthful expression, his teeming imagination produces. The painter transfers to the canvass the ideal forms his genius calls into existence. These creations of art, when they embody the ideas of beauty and truth innate in the mind, acquire vitality ; they live from age to age the admiration and wonder of succeeding generations. Nations strive to possess them : a princely revenue, or a government treasury alone can command their purchase.

The mechanic, versed in the laws of physics, conceives in his understanding in all its separate parts, a complicated mechanism. He produces a material machine the copy of his immaterial thought. It augments the sum of human or animal labour, and is equivalent

to the addition of millions to a nation's population. The machine power of England is estimated to equal that of a population of two hundred millions of men.

But why particularize? Whatever is the work of man's hands, whatever assumes a form and body from his labour, is an external copy of his interior thought and idea. Thought, the idea, is the universal creative impulse.

But what is this mind of which we have so entire a consciousness? What this thought, these ideas, so clear and distinct to us? What this will, whose energy triumphs over all natural obstacles, to perfect the ideal in the real? Nothing is more familiar to us; they are in us, a part of us, they are the all of us. Abstract these, and man ceases to be. Yet nothing is less known. What they are, how they are, are questions that have not been, that never can be, solved. We know their operation, we witness their effects, themselves for ever hidden.

So is it with the force and phenomena productive of organic forms. We behold daily, hourly, their influence and results. But them we know not. In watching from hour to hour the formation and development of the plastic fluid, tissues, and organs in the hatching of an egg, we are present at, and witness the creation of, a living being. Though the eye sees the phenomena, the understanding cannot comprehend their cause. Phenomena and their laws are the limit of the human intelligence. First causes, forces producing phenomena, transcend human intelligence. To us they are miracles. When this point is reached investigation ceases; reason is silent; man adores.

Medicine has long been involved in the sterile doctrines of materialism. It could not be otherwise while investigating the material structure of organized beings. The analysis of material phenomena; the study of the material substrata of phenomena,—a stage of investigation through which every science must pass,—leads, almost of necessity, to the philosophy of materialism. But when this period is passed, and analytical science has accomplished its work, knowledge is found to be incomplete. There is something beyond the phenomena: it is the law of their existence, which, if unsolved, science is barren, and philosophy is lifeless.

To complete a science, its "membra disjecta," its scattered

fragments of phenomena, shattered by experimentation, are to be brought together, and by a synthetical combination, again re-constructed in their original unity.

This point medicine now touches. The analysis of the material phenomena of living beings, though not finished, approaches its completion. The end may be seen. The synthetical combination of organic elements into tissues, organs, and living beings, is now the subject of investigation. It has created genetic anatomy. Though man is incapable of that greatest of experiments, the creation of a living organism, yet Nature performs it for him, and under his direct supervision. But in vain does he seek in material phenomena or laws, the causes of the creation of the endless organic structures—organs and individual organic forms of the myriads of beings that cover the earth's surface. Science is compelled to fall back on the spiritual, the immaterial, the dynamic, in which it always commences, as the only rational source of this class of phenomena.

The doctrine of forces, a contested question of philosophy from the earliest ages, is assuming in modern science a tangible shape. The active forces of nature, light, caloric, gravity, chemico-electric power, and organic force, co-ordinate forces in the production of natural phenomena, appear to be emanations from the sun, the centre and governing power of our planetary system. This glorious symbol of the universal and eternal Creator, is the immediate instrument, through these forces, of his power in the production of the physical and organic phenomena of our globe.

Hippocrates laid down an axiom that lies at the base of medical science. It cannot be neglected without falling into error: "In every act of life," he observes, "whether studied in its state of health or of disease, there are three elementary phenomena—the *elementa continentia*, containing or solid parts—the *elementa continentia*—the fluids or contained parts; and the *impetum faciunt*, or the forces causing action."

This profound and comprehensive view has been neglected in all subsequent time. Each element at different periods, has been separately made the basis of a medical system. Humoralism, solidism, vitalism, have been alternately ruling doctrines. At no time has any medical doctrine been erected on the broad and solid basis of

the school of Cos, and the above philosophic axiom of the father of medicine.

In this country, solidism, with a tinge of vitalism, has been predominant in medical opinions. Humoralism, repudiated after a domination of a hundred centuries, is reappearing in Europe in an imposing attitude, with the attributes of an improved science. It must henceforth be admitted a constant element of the pathological problem.

Exclusive solidism—organic medicine, the doctrine of the Paris school, professed by many in Europe and this country, is as far removed from truth, as exclusive humoralism, or vitalism. It is probably more barren than either in practical results. Except when attacked by chemical agents, the solids can be affected only through the forces, and organizable material of the combined action of which, they are products. The solids have no persistent existence, excepting the mechanical tissues as—cartilage. They are destroyed and renewed by the acts of life, in each moment of life. Natural structure is an evidence that the organizing force of life, and the organizable material, are undisturbed in their mode of nutritive action—that both are normal. Alteration of structure, pathological products—are an evidence, that the organizing forces, or the organizable material, or both are no longer normal. Organic lesions must be preceded by disorder in the modes of the organizing force, or in the constitution of the organizable substance.

Pathological anatomy has revealed the results of disease, when the organic forces, or organic substance are sufficiently disturbed to affect structural formation. It is silent as to all others. This is the extent of its contributions to medical science. It is now completed; its facts are exhausted. Yet medicine is as far from the term of its completion as before. No clear therapeutic indications are derived from structural changes. In the treatment of diseases, medicine has not been enriched or materially benefited through pathological anatomy.

The third element of vital phenomena, the forces—*impetum facientes*—in the physiology and pathology of the present time, is unnoticed, or underrated. It has been my object in this discourse to call attention to its peculiar character, and to bring it prominently

before you as an essential element in every vital act. The radical force of life is present in every living action. It is that which distinguishes the living organ from the dead organ. It creates the living structure, maintains its type, and repairs its injuries. It is the conservator of the economy in health; its renovator in disease.

A knowledge of the fundamental or primary laws and facts of life, is not a subject of mere speculative interest. Like all great truths, it is pervading and practical. It runs through all medicine; it is the root of the science. A few remarks will establish this position. Life is a continuous succession of phenomena, the repetitions of its first commencement. The whole organism is experiencing incessant changes. Each particle decays, dies, is removed; it is replaced by another. Yet is there no change in the tissue and organ, either as to organic composition or form. They remain the same. The same forces and actions that first created, continue to reproduce each organic particle and each organ, after its original plan. The force that originally produced the organism, is conservative of the organism.

The animal economy of man, is surrounded by antagonistic influences, that tend to its destruction. It maintains an incessant conflict with the general forces of nature, under which, sooner or later, it succumbs. The resisting and protecting power of the organism, is the fundamental force of life, the vital or organic force and the formative actions depending on it. As long as their energy is superior to aggressive and disturbing agencies acting either from within or without, the normal or healthy condition of the structure and functions is preserved. But when the last possess the ascendancy, either from the intensity of their power, or from an accidental enfeebling of the vital forces, derangement of action, disorder, disease, lesions of structure, or functions, or death, may ensue.

In the fluids vital force is at zero. Its greatest energy is exhibited in the solids. The fluids from this cause and the complexity of their constitution, are endowed with the least resisting and protective power. They are the most disposed to be acted on of all the organic materials, and the most susceptible of change. Hence changes and modifications in them, are the most common of the pathological conditions, and the cause of so many of the diseases, that assail the economy of man.

In disease the vital forces or laws continue to exercise their protective power. Through them recuperation and healing are chiefly accomplished. Without their aid, medicines are inefficient and disease fatal. While, in numerous cases, they are sufficient to the cure, without the assistance of medicine, and often effect it, opposed by the action of medicines injudiciously administered by the ignorant.

Medicines are curative in their actions when they accord with the restorative laws and actions of the economy. When they operate in opposition to these, they are useless, or mischievous. Many of the symptoms of disease, are, in fact, restorative processes excited by the recuperative laws of provident nature, for the defence and recovery of the economy against destructive influences, or from a morbid perversion of the organic actions tending to death. Such are hemorrhage, vomiting, purging, sweating, expectoration, urination, eruptions, abscesses, and metastasis. Inflammation, and fever, in the sense of reaction attended with augmented temperature and active circulation, I would place in the same class.

Some one or more of these processes are brought into operation in every disease, and in those of great severity, nearly the whole are simultaneously or consecutively put into requisition. Certain diseases are characterized by the constant recurrence of some of those phenomena, which appear to be the specific means by which the economy frees itself of particular offending causes, or escapes from special states of suffering.

While the economy is, in this manner, its own physician, and effects the cure of its diseases by its own laws, yet, the imperfection that belongs to every thing connected with this world, attaches to its modes of action. They are not always limited to the obtaining of the end intended. They are excessive, or deficient; or the forces of life may be so oppressed by the intensity of the morbid cause, as to be incapable of bringing into play their curative operations.

For these emergencies, the providence of the Creator, has provided numerous agents in the vegetable, animal and mineral kingdoms, endowed with properties capable of exciting operations, similar to the curative operations of the economy, or of governing and controlling them, when irregular. These constitute the *Materia Medica*, and the use of them, for the assistance of nature in the cure

of disease, forms the art of the physician. The true physician knows himself to be the minister of nature and the servant of God. He, who has studied in the school of nature, who is acquainted with the laws governing the animal economy, who knows how best to follow her modes of curing disease, and to give to her sanative actions their most appropriate direction, will prove to be the most sound, safe and successful practitioner. He will know when and how the interposition of art is required, and when and how its active interference can only be injurious.

The self-healing power of the economy, is strikingly manifested in the reparations of injuries. Whatever may be the structure that is injured and requires to be restored, one material only is employed, the plasma of the blood. This is effused in and around the injured parts; it is organized into bone, or tendon, or muscle, or nerve, or membrane, or skin, as the case may require, and the part is restored to its uses in the economy.

If the natural history of diseases were better observed, it would be found that the self-healing power of the economy is equally sanative in pathological conditions. All acute diseases must terminate in a limited time, varying from some hours to some weeks. Seven tenths of the ordinary acute diseases prevailing in society, recover without other aid than repose, regimen and tranquillity of mind. In the remainder, the economy, incapable of combating unassisted with morbid influences, or the pathological changes they have occasioned, requires the assistance of appropriate remedies, administered at the opportune moment.

Chronic diseases which most frequently involve alterations of structure, or derangement in the mechanism of the economy, need the aid of art, either to prevent, to alleviate, to palliate, and when curable to cure.

Simple and obvious as are these truths, they are so seldom thought of they appear unknown. Every recovery is attributed to some specific curative virtue of a nostrum, or is appealed to as an evidence of the truth of a practice or of an hypothesis, or is assumed as an evidence of skill. Nature receives no credit; while recoveries are infinite and cures are rare. The quack, the pretender, the ignorant, ascribe to themselves and their specifics what has been the

work of nature. Administering without skill and judgment, their successes are hazards, on which they cannot even calculate.

The physician familiar with the recuperative laws of the economy and the laws of disease, producing and governing the phenomena through the progressive stages of each affection, knows that when his interposition with active measures is required in aid of the inefficient efforts of nature, the time, the opportunity, and the mode of applying his remedial means, as adapted to the state of the patient, the period and the manner of termination of the disease, determine the success, or the failure of his operations. Acting in conformity with this knowledge he does not err; fatal mistakes are not made in critical moments, but rescues from danger are the triumphs of his skill and judgment. With nature, medicine is all powerful; without her, helpless; opposed to her, mischievous.

With the physician well grounded in his science, his proceedings are calculated on positive principles or facts. He foresees and predicts results, he anticipates events, and provides beforehand against difficulties he knows likely to occur, so as to diminish or avert them. This is knowledge; it is the extent of man's power.

A self-curative power in the economy, was an early observation in medicine. A study of the natural methods of cure, laid the foundation of the medical art. This power has been recognized through the long era of our science. It is variously expressed by different authors. It is the *enormonta*—active forces and *phusis-nature*, of Hippocrates, and the Greek writers. It is the *impetum faciens* of the Latins; the *archæus* of Van Helmont; nature of Baglivi, Harvey and Sydenham; the *autocrateia*,—self-forces, of Stahl; the *anima* or soul of Whyt; the *vis medicatrix naturæ* of Hoffman and Cullen. The facts are positive: for they are perennial, running through near three thousand years of observation, and are seen daily at this time, as they stand recorded in the first annals of our art. The facts are the same: the explanations, the modes of seeing and understanding the facts, and the nomenclature, differ according to the varying knowledge and philosophy of the age. The first alone interest us: they belong to nature. They compose the solid body of our science. The last are transitory accidents, and become finally the curiosities of medical literature.

In the course of medical instruction committed to my charge, it is my duty to make you acquainted with the phenomena, and the laws of the living economy of the organism in action.

In the Institutes of medicine are examined and explained the phenomena of life, as manifested, in its forces, in the fluids, and in the solids or organs, in their normal or healthy, and in their anormal condition, modified by disease, or medicinal and remedical agents. The field of inquiry is extensive: it cannot be covered in a single course. The phenomena are numerous, complex, difficult to investigate: but they can be established by patience and perseverance in experiment and observation; and by accumulated knowledge.

Medicine as a science and a philosophy must be perfected in the Institutes.

In pursuing these investigations, it is impossible to refuse the conviction, that in life no phenomenon, however trifling, is an accident. Every thing is designed, has an intention, is the result of laws proceeding from the First Great Cause. It is the business of the physician who would practice skilfully his noble art, to penetrate those designs, to comprehend those intentions, to know those laws, as connected with disease, that he may direct them for salutary ends.

Imbued with this knowledge, ripened by experience, the physician will be guarded against mistaking for the truths of science, the delusions of his own, or of others' fancy. He will form no exaggerated pretensions, like those who are ignorant of the natural laws of the animal economy, to the wonderful and supernatural in the healing art. Medicine he recognizes as a system of nature, not as systemized miracles. He feels it no diminution of professional dignity and pride, to be called the servant of nature, "the hands of heaven." One of the great authorities of our science, the celebrated Baglivi, has drawn the character of a physician in the opening section of his work. "*De Praxis medicâ. Medicus est Naturæ Minister et Interpres: quidquid meditetur et faciat, si Natura non obtemperat, Natura non imperat.*"

The physician is the Minister and Interpreter of Nature, whatever he meditates and does, he governs nature by obeying her.

I invite you to form on this model your professional character. It will demand of you acquirements in knowledge, discipline in methods of observation, and a training in science.

My colleagues and myself devote our abilities to assist you in the effort. It will be to us a source of generous satisfaction to know, that you will have deserved and have gained this high reputation. It will be the pride of our school, that its pupils should be distinguished as the ministers and interpreters of nature.