Introductory address to the course of medical lectures : at Georgetown College, November 3, 1862 / by Silas L. Loomis.

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TO THE

Course of Medical Lectures,

AT

GEORGETOWN COLLEGE,

NOVEMBER 3, 1862.

By SILAS L. LOOMIS, A. M., M. D.,
PROFESSOR OF PHYSICS AND CHEMISTRY.

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ADDRESS.

GENTLEMEN:

We may well congratulate ourselves that, in the midst of such a convulsion as now agitates our country, when to such an extent the arts of war have supplanted those of peace, we are met under circumstances so auspicious, to inaugurate our Course of Lectures. Untouched by the shocks of civil war, its carnage and devastations, we meet to renew again our quiet investigations in the arts of healing and relief of suffering.

Especially may we congratulate those who are now entering upon these studies. Amid these lurid clouds, shines a favorable sun for those who would learn to touch with magic wand and power, the ills to which humanity is heir. Many circumstances combine to render this a favored hour—an hour of privileges, opportunities, and responsibilities. And to us, to you young gentlemen, located within the lines of the army, as it were upon the very field of battle, whose smoke has scarce been rolled away, ere its unfortunate victims are brought to your feet for the healing balm that shall keep the quivering pulse still in being, or for the sterner purpose of severing the living from the dead—to you especially, is this a propitious hour. To be thus situated is to enjoy a privilege rare indeed, and which, while we prize, we may trust, and pray may not be ours or yours again.

But these special privileges come not without their correspondent responsibilities and obligations. Humanity has a right to demand, and does demand that such a grand experiment of human endurance, capability, strength, sickness, accident, and death, shall not pass without its great lesson to the medical profession. If Hygenia finds in Mars her most implacable enemy, she nevertheless must, in justice, acknowledge him her most lavish patron. This is no hour of idleness. If the profession is true to itself, true to this

age and its crowding events, the present decade must witness a decisive advance in American surgical and medical science.

But there are other reasons besides these already alluded to, why we are standing at the threshold of such a promising future. The perfection of the Microscope and of chemical tests, have reduced the basis of medical knowledge from theory to demonstration, from the vagaries of imagination to the immutable certitudes of truth. And when the human mind has once laid bare the great foundation truths, slowly but securely with every new demonstration rises the majestic and imperishable temple of science.

Not that the past has not well fulfilled its mission. Nay much has been done and well done; and when we may number but little less than a thousand published works on the subject of Materia Medica alone, we may well be assured that, taken in all its departments, few branches of knowledge have made a more honorable record for itself than the Medical. Yet honorable and voluminous as is this record, we must not forget that the rapid progress of recorded discovery has largely, and must soon more, widen the distance between these works and us. They were valuable for the times they were intended to instruct, but valuable to us only so far as their instructions will stand the test of the microscope and the crucible. The present is, therefore, almost a new instauration of the sciences of Organic Chemistry, Pharmacy, and Physiology. The introduction of the microscope into these departments has been the most important step taken in the history of these sciences.

Books, therefore, lie necessarily behind the profession. Each year brings its generous accumulation of newly established truths, made known through journals and magazines. These, therefore, must stand between the library and physician; but neither the one nor the other, can nor should, keep pace with the persevering intelligent seeker of truth.

Science is but the collection of nature's laws, as discovered in the various researches of men of all ages. Books, therefore, must be the substantial basis of the intelligent, the

successful physician; and yet he, who at this day, comes no nearer to nature than to see through eyes of others will soon find himself pushed aside by his living compeers, and laid upon the shelf as a fossil of the past.

One course alone lies open to the student in this stern, incredulous age of tests and micrometers. It is the old fable of Œdipus and the Sphinx, he must guess the riddle or be devoured. Reverting back to those first principles that admit no question, that are received as acknowledged truth, rejecting all that is speculative or chimerical, he must patiently add truth to truth, seizing it eagerly wherever found, closing no avenue of its approach, rejecting no system or theory as a whole, adopting none, conserving the truth of all, and discarding the error wrapped around with whatever sage mantle of antiquity, till in the grand symmetries of nature, Science begins to display her own matchless beauties and conditions. This and this alone is the passport of every man who would honor his profession and benefit his race.

It seems fitting, therefore, that in the commencement of this Course we should turn back for a brief review of the prime principles upon which all medical science rests.

In medicine, as well as in all scientific research, chemistry is at the true base. Chemistry in its broadest sense may be defined to be "that branch of natural science, whose object is to investigate the nature and properties of inorganic and organized bodies, and to study the force by which every combination is made."

The first object has been comparatively well developed. The laws which govern chemical action in its various forms as manifest in what are known as the Ponderable elements and their infinite combination, are well known and acknowledged as facts. Chemists are well agreed as to the constitution of these bodies. The Atomic Theory of Dalton is taken as a basis, and on it all our ideas of the composition of ponderable bodies rest.

The second object of chemistry, viz: "to study the force by which every combination is made" has not been so suc-

cessfully attained. The almost insurmountable difficulties attending the investigation of imponderable material, and the tendency to attribute everything not readily explained to some spiritual influence have almost prevented any successful research. The early investigations or theories are hardly worthy of notice. The laws of ponderable matter were so little known that no aid could be gained analogically from them, and the imagination was left unchecked in its wild and fanciful dreams.

Gradually, however, as the laws of ponderable matter became known and fixed, these theories yielded to others having a nearer approximate to the truth; till at length the laws of the imponderables themselves were, to some extent, developed. Electricity, under its various forms, of the voltaic current, magnetism, electro-magnetism, magneto-electricity, thermo-magnetism, heat, light, and certain forms of attraction, were studied, and a multitude of facts collected, yet we groped in utter darkness as to their real nature.

Following these came Animal Magnetism, attributing certain unaccountable phenomena to a new force, or the force of magnetism modified by the living organism, especially the human. This soon led to Spiritualism, which included certain phenomena attributed to some spiritual influence. The doctrine of Spiritualism of the present day is most noticeable for the rapidity of its spread and the control it exerts over the minds of its votaries. Thousands to-day employ none but spirits, manifested through some medium, as their physicians. This condition of things challenges the scientific world and especially the medical, to investigation. In reply, I am bold to say, we are ready to meet the issue, not, indeed, to enter into an examination of certain phenomena, said to occur under such and such circumstances, nor to offer any explanation of said phenomena, but by establishing the true laws of nature to expose the error of the whole scheme.

Investigations at the present proceed very differently from those of former times. Then science was an accumulation of theories; now the interconnected chain of established

truths. Then theories were continually rising or falling, as here and there some fancy might strike some leading mind; now each succeeding age and every philosophic mind brings its contribution to the immutable structure of facts. These truths constitute the constantly-extending base of further research, and nothing can be accepted as truth which contravenes any of the already demonstrated laws of nature. Not only so, but it must render a satisfactory solution of some phenomena hitherto unexplained. Thus and thus only can it win its way to the confidence of the scientific mind.

For the past twenty years, many of our best philosophic minds have been examining the forces of nature; and such phenomena as could be explained have been repeated, till certain laws were established from which to generalize. The fog has not been lifted, but the glimmer of day dawn certainly appears.

The subject of Correlation and Conservation of forces was the first generalization suggested, though uncertainly and unsatisfactorily to any. The subject was approached from different stand-points, until finally the conclusion was reached, that "all the various forms of imponderable material were convertible; that light was another form of heat; that the different kinds of electricity were simply owing to the different manner of its production." This doctrine soon included life, or the vital part of animal existence.

In 1836–'37, Dr. Samuel Jackson advanced the idea that "Physiology might be very properly designated as organic physics." In 1843 Mayer promulgated the same opinion.

In a course of lectures, in 1843, on this subject, I used the following language: "There is an æther prevailing all creation which exhibits itself under the forms of electricity, galvanism, magnetism, light, caloric, &c.; and though electricity is not magnetism, or caloric, or light, it is the same fluid under a different form. *So with life or vital force, it is one form of this æther, and exhibits itself differently as it acts on animal, vegetable, or mineral substances.*"

In regard to ponderable material, the following occurs: "Among all the infinite variety of compound substances,

the chemist reckons only fifty-five elementary ones, and these they do not assert as absolutely simple, but call them so for convenience. The probable truth is, that there is only *one* simple ponderable substance." But Mr. Grove, of London, published the first treatise upon this subject, and in the edition of 1850 throws out the conjecture that the doctrine of correlation will apply in physiology.

A noticeable paper was read by Prof. Joseph Le Conte, before the American Association for the Advancement of Science, at its meeting in 1859, at Springfield, from which I quote the following:

"Matter constantly changes its form, but is itself i ndestructible, except by the same power that called it into being. The same quantity of matter exists in the universe at all times. So, also, force changes its form constantly, but is itself indestructible, incapable of increase or diminution, and the same absolute amount of force exists in the universe at all times and forever. The mutual convertibility of the various forms of force is 'correlation of forces.' The invariability of the absolute amount in the midst of constant change is called 'conservation of force.' This principle of correlation and conservation of force must be looked upon as one of the grandest generalizations in modern science, a principle startling at first, but when clearly understood and firmly grasped, almost axiomatic. It must be considered a necessary truth, and as such is a legitimate basis of deductive reasoning."

"The correlation of *physical* forces is universally recognized as a principle in science, and not only so, but has already been productive of many beautiful and useful results; but the correlation of physical and vital forces, while generally recognized as a probable fact, has only been speculated on in a vague and as yet unfruitful manner. The science of life is scarcely yet ripe for the legitimate extension of this principle over its domain."

"There are four planes of material existence which may be regarded as being raised one above the other. The *first* and lowest is the plane of elementary existence, the *second* the plane of chemical compounds or mineral kingdom, the *third* the plane of vegetable existence, and the *fourth* the plane of animal existence. Now, it is apparently impossible for any known force in nature to raise matter through all these grades at once. On the contrary, there is a special force

adapted for the elevation of matter from each plane to the plane above. It is the special function of chemical affinity to raise matter from plane No. 1 to No. 2. All the changes, too, which take place upon plane No. 2 by the mutual reaction of bodies situated on that plane, are under the guidance and control of this force. It is the special prerogative of the force of vegetation, of vegetable life, to lift matter from No. 2 to No. 3, *i. e*,, from the condition of mineral matter to the higher condition of vegetable matter. All the changes which take place upon this plane, the laws which constitute vegetable physiology are under the guidance of this force. Finally, the force of animal life, and that alone, enjoys the privileges of lifting matter still higher into the fourth plane, *i. e.*, the plane of animal existence. No force can lift from No. 1 to No. 3, or from No. 2 to 4. Plants feed entirely upon elementary matter, nor can animals feed upon mineral matter. * * Thus it seems that after matter is raised from the elementary to the mineral condition, it requires an additional force, of another and peculiar kind, to raise it into the vegetable kingdom, and again another accession of force to raise it into the animal kingdom. * * If, then, it be admitted that this is the relative position of these planes—that it requires a greater and greater expenditure of force to maintain matter upon each successive plane—then it follows *that any amount of matter returning to a lower plane by decomposition must set free or develope a force which may, under favorable circumstances, raise other matter from a lower to a higher condition.*

"Again, in the same manner as matter may be arranged in several distinct and graduated kingdoms, so it seems to me the forces of nature may also be divided into distinct groups arranged in a similar manner, one above another. These are the *physical*, the *chemical*, and the *vital* forces. And as in the case of matter so also in the case of *force*, it is impossible to pass directly from the lowest to the highest group without passing through the intermediate group."

The broadest generalizations, however, yet reached, were published by Professor Joseph Henry, Secretary of the Smithsonian Institution in 1857, in the Patent Office Agricultural Report. In an extended article upon Meteorology, he speaks thus of the constitution of matter, p. 422:

"All the objects which are presented to us in the material universe, and all the changes which we observe taking place continually among them, whether those which immediately

surround us or those which we perceive at a distance either by the naked eye or by means of a telescope, are referable to two principles—matter and force. By the former we understand the substratum of that which affects our senses, and by force that which produces the changes which we observe in the former. * * But we cannot imagine a force without some bodily substance against which it is exerted; the two ideas, therefore, of matter and force, are coexistent in the mind, and on a clear and definite conception of them depends that precise relation of the phenomena denominated Science. Though the essence of force and matter may never be known to us, we can study the laws by which they are governed, and adopt such a constitution of matter as will enable us to generalize a vast number of facts. * * * But such a generalization must be based on the well established principles of the laws of force and motion, and be in strict accordance with accurately ascertained and properly estimated facts in the various branches of physical inquiry, in order that it may be an exact expression of the apparent cause of the phenomena, and that the prediction from it may be true in measure as well as in mode.

"In connection with the laws of the forces and motion of matter given above, we shall venture in this essay to express some of the widest generalization of the present day in the form of what is called the Atomic Theory. * * * * According to this theory in its widest conception, every portion of the whole universe, or at least that part of it which is accessible to us by means of the telescope, is occupied by atoms inconceivably minute, hard, and unchangable, separated from each other by attraction and repulsion. This assemblage of atoms, constitutes the matter of the material universe, and the attractions and repulsions, the forces by which they are actuated, and to which is referable all the power or energy which produces the changes to which matter is subjected.

"These atoms, thus endowed, form a plenum throughout all space constituting what is called the etherial medium, and in it, at wide intervals from each other, are isolated masses of grosser matter which constiute our world, the planets, the sun, and the stars. These also consist of atoms of another order, or groups of atoms with spaces between them wide in comparison with the size of the atoms, and these spaces pervaded by the minuter atoms of the ethereal medium. * * According to this theory the various isolated bodies of the universe act upon each other by means of the

force of gravitation, and also by tremors and vibrations in this medium, radiating in every direction from each body as a center. * * *

"We are obliged to assign to the ethdreal medium a similar constitution to that possessed by grosser matter, viz.: that it consists of inert atoms at great distances from each other relative to their own size, and each kept in position by attracting and repelling forces. Through this medium impulses or minute agitations are transmitted in celestial space from planet to planet, and from system to system, and these tremors or waves constitute light, heat, and other emanations which we receive from the sun; or, in other words, the solar emanations are not matter but motion communicated from atom to atom, beginning at the luminous body and diffused in widening spherical surfaces, enlarging in size and diminishing in intensity, to the farthest portion of conceivable space. * * *

"The phenomena of light, of heat, of the chemical and phosphorogenic emanations, have all been referred to vibrations of the ethereal medium, and all the facts which have thus far been observed are in accordance with this generalization. The question, however, naturally arises as to what explanation we can give of the multiplied and various phenomena which are constantly presenting themselves to us in connection with all changes which are taking place around us in Nature, or which exhibit themselves to the chemist and physicist in their investigations of the minuter reactions which are brought about by their agency, and which are classed under the general term of electricity. * * * Now these phenomena may be referred to an accumulation of the ethereal medium in one portion of space, and corresponding diminution in the adjacent space around. If the particles of the ethereal medium, when thus accumulated, act at a distance on other portions of the same medium, we shall have a rational exposition of the phenomena of statical electricity; and in the restoration of the equilibrium of the medium, or in its return to its natural condition, we have a plausible cause of the dynamic effects belonging to the same class. * * *

"But what is this vital principle which thus transcends the sagacity of the chemist and produces groups of atoms of a complexity far exceeding his present skill? It is generally known under the name of the 'vital force;' but since the compounds which are produced under its influence are subject to the same laws, though differing in complexity, as

those produced by the ordinary chemical forces; and since in passing from an unstable to a more stable condition in the form of smaller groups, they exhibit, as will be rendered highly probable hereafter, an energy just equivalent to the power exerted by the sunbeam, under whose influence they are produced, it is more rational to suppose that they are the result of ordinary chemical forces acting under the direction of what we prefer to call the vital principle.

"The general conclusion which has been arrived at is, that all the different physical energies, whether that which is called chemical action, heat, light, electricity, magnetism, or muscular motion, or mechanical power, are all referred to the disturbance of the equilibrium of the atoms, and its subsequent restoration due to their attractions and repulsions; and that all these forms of energy are in one sense, as it were, convertible into each other; or, in other words, the force generated in the restoration of the equilibrium in one case is sufficient to disturb it, though in different form, perhaps, in another."

I now propose to extend these generalizations by classing the "ethereal medium" as a constituent element, subject to all the laws that are commonly resticted to gross matter.

In 1843 I advanced a similar theory, and taught it in the lecture room for the following years. The theory as proposed was expressed in the following laws:

"1. All created substances exist under two forms, ponderable and imponderable.

"2. A definite amount of ponderable substance was created at the beginning, and has been neither increased or diminished.

"3. A definite amount of imponderable substance was created at the beginning and has been neither increased or diminished.

"4. All the forms of ponderable matter are but the aggregation of elemental ponderable atoms, connected with varying quantities of imponderable material, under different circumstances and relations.

"5. All the forms of imponderable substance, are but the various manifestations of elemental imponderable atoms, under different circumstances and relations.

"6. Imponderable substance in definite quantity, must form an elemental constituent of every ponderable body."

It will be readily perceived that the first five of these laws, entirely correspond with the theory enunciated by Professor Henry in 1857, and that, in addition the "atomic theory of Dalton," is extended to cover the imponderable as well as ponderable material, or, in other words, it extends over all the matter which falls within our cognizance, ethereal as well as gross.

For the sake of convenience I have called ponderable or gross matter, Materia, and the imponderable or ethereal medium, Ætheria, abbreviating them Ma. and Aa. I shall not at this time further refer to the first five of these laws, as Physicists accord to them the high rank of well established principles.

The sixth invites our attention.

If it be true, that Ætheria enters into every compound as a constituent, then it is apparent that what we have hitherto regarded as analyses, are so, in fact, but in part. One essential has been overlooked, and the whole formulary of Chemistry has to be recast.

In the article previously referred to as containing the latest generalizations, we have the idea of atoms, but nowhere, the notion that these atoms of Ætheria, are subject like those of Materia to the laws laid down by the Atomic Theory. I propose in law 6, to extend the entire Atomic Theory to Ætheria, thus recognizing it as a constituent element of matter in its general sense.

We are thus brought to the consideration of the grounds on which this more extended generalization is believed to rest.

There are certain phenomena exhibited by many substances, simple as well as compound, that have ever perplexed the Chemist, the exposition of which is, by this law made satisfactory. Not less effective will the physiologist and the pathologist, find it in solving a multitude of phenomena hitherto enveloped in mystery.

A class of phenomena, quite general, called Change

of Form in bodies, illustrates precisely the part this new element plays in chemical composition. Ice, a dense, brittle, vitreous substance, when heat is applied, bringing its temperature to 32° F., remains stationary till 140° to every pound has disappeared, when it changes its form and becomes liquid, losing most of its original properties and assuming others. It is said that this 140° of heat becomes latent. Now what is the meaning of this explanation, if explanation it be? Where is this 140° of caloric? To say that it is latent, is to say it has vanished, *i. e.* to say nothing.

Heat is simply the particles of ætheria in a state of intense vibration; and when the heat becomes latent, or disappears, or at least so that its vibrations are not detectable by the thermometer, the simple question is, what has become of these vibrating particles of ætheria? The same cause that commenced the vibration still continues, and yet the vibration has ceased! Are there any indications that point to what is taking place? The same law that gives us the solution to all established chemical changes, if applied, will give a solution here also. Why not then apply it? Oxygen brought into contact with certain substances disappears—*i. e.* becomes latent—can no longer be found, and we say it has combined to form a new substance. Here heat has disappeared, and a new substance is formed; why not carry out the analogy of its having entered into combination, as well as oxygen?

Again, let the heat be continued and the temperature rises with uniformity, until the point of 212° F. is reached, when a second absorption takes place, and 1008° F. to every pound of water, vanish. As before, these particles of ætheria having entered into actual combinatiou with the water to form a new substance, can no longer vibrate, and of course cannot effect the thermometer. Ice, water, and steam, therefore, form a series of bodies, whose general formulæ is H. O. Aax., in which x varies as the number of equivalents of ætheria vary. If we reverse the process, and reduce the steam to water, the element ætheria as soon as liberated, resumes its vibrations, and exposes its presence as heat.

This condition is general. A chemical building up absorbs surrounding vibrating particles of ætheria as an element of the new compound, and whenever this runs down, ætheria is liberated, and through some manifestation exposes is presence. The law, therefore, that all the physical properties of a body depend upon its chemical constitution, appears to be true in its broadest application. Water, ice, and steam are as much different compounds as the atmosphere, laughing gas, and aqua fortis.

A class of phenomena, called Allotropism, to which no satisfactory exposition has been given, is very closely allied to the above. Indeed, there is no good reason known why water may not be called an allotropic condition of ice. The phenomena are so closely related that it is not easy to say wherein the difference consists. Ice, without any additional element, changes its properties; in the same manner sulphur, without any additional element, changes its properties. In one case it is called "allotropism," and in the other "a change of form." Perhaps we shall be able to understand better the difference if we translate the *Greek* word Allotropism. It means *to change to another*. The difference may be that the one class of phenomena is a common occurrence, while the other is confined to the laboratory. The only real difference is that in one case the change of form takes place in compound bodies, and the allotropic condition in elementary or simple bodies.

Among the elementary bodies are chlorine, phosphorus, sulphur, &c., that under certain conditions, without the addition of any Materia whatever, assume entirely different properties, to such an extent as to lose their identity. They are then said to be in an "allotropic condition," oxygen becomes ozone, sulpher loses its properties and becomes more like gutta percha, phosphorus is no longer identified, chlorine assumes new properties, &c. It is a fact worthy of notice in regard to these remarkable changes, *that no elementary body assumes its allotropic form, without being exposed to Ætheria, either in a condensed form, or in an intensely vibrating or disturbed state.* It is equally true *that no* COMPOUND

BODY *assumes its change of form without being exposed to Ætheria, either in a condensed form or in an intensely vibrating or disturbed state.* Both results are produced under the same law, and originate from the same cause. Thus Allotropism is readily explained by the addition or diminution of ætheria as an elemental constituent of the body. In the case of Ozone there are cogent reasons for believing that its production is caused by depriving Oxygen of one or more equivalents of ætheria. It may be, however, that ætheria has been added.

Another subject inviting our attention is Isomerism—an anomalous condition of certain substances, seeming to stand in the face of this prime law of chemistry, that difference of properties is due to a difference of composition. Many substances are found of very essentially diverse qualities, which upon analysis, disclose precisely uniform elements and uniform proportions. Liebig finds that the essential oils of juniper, rosemary, turpentine, copaiba, and the essence of lemon constitute such a class. Much as these substances differ in taste, odor, medicinal qualities, boiling point, and specific gravity, they are entirely uniform in elements and proportions.

It is to be noticed in reference to these bodies that they are of unstable composition, and the atoms can sometimes be made to change their position by an impulse from without, or by the adition of heat, and then combine again, forming other substances having entirely different properties.

It is generally laid down in articles upon Isomerism that "these remarkable facts can only be accounted for by the different groupings of the atoms;" that is, whilst all the various bodies have only the same elements out of which to construct, it is supposed that each has its own peculiar method of arrangement, by which is thus produced results of such widely different characteristics. The grounds of this supposition are not any known facts that there is such a peculiarity of groupings, nor any analogies elsewhere in chemistry, in truth the analogies are uniformly against it, but simply that it affords an explanation to what has been hitherto regarded as otherwise unexplainable.

But are these phenomena otherwise unexplainable? Have we not already found the element wanting to show the real point of difference? Now are there any indications that ætheria is the varying element in these similarly constituted substances? It is worthy of note that among the specific points of difference, besides the odor, medicinal effects, &c., was the *boiling point, thus clearly indicating some essential constitutional difference in the amount of ætheria.* Thus, then, these bodies instead of being Isomeric, having a uniform constitution of Cn. Hp. appear to revert back to the general condition of all chemical combinations, and have the general formula of Cn. Hp. Aax, in which x varies as the number of equivalents of ætheria vary, and the law that physical properties depend upon chemical composition, holds good.

We are therefore necessitated to choose between these two conclusions—to set aside a well established law of chemical condition, and adopt a hypothesis without warrant of fact and against analogy, or to make the Atomic Theory universal over the imponderable alike with the ponderable material, thus affording a full and satisfactory exposition of Isomerism, restoring the law of chemical condition, and making science harmonious.

It is pertinent to say that the introduction of a new constituent element, Ætheria in all chemica lanalysis will modify methods of research, and give precision to many hitherto unsatisfactory investigations. It opens a wide field for the modern chemist, and promises laurels for his brow. As important as this may be to the Chemist, it is scarcely less so to the Physiologist and the Pathologist. Bearing in mind that the addition of this new element to already existing compounds, does not destroy but modify existing laws, it is important to inquire what laws of living organisms depend upon the new element, ætheria. The science of life or vital force is ripe for speculation and theory but not for scientific investigation. When the laws dependent on the new element ætheria are fully developed in the inorganic world, when understood in vegetable organizations, then it will be time to push our inquiries to this more subtle material of the most complex living organism.

Without going, at the present time, into the exposition of vital force, we may be enabled to explain certain physiological and pathological phenomena more satisfactorily by this new generalization, than by any other existing law.

The production of "animal heat" has given rise to various theories and speculations, none of which have proved satisfactory. The most correct generalizations on this subject are that the greater portion of material consumed by man, about a ton and a half each year, is oxygenized or burnt, *i. e.* from a highly organized, unstable condition, it has been degraded to an unorganized and more stable form; and that during this process which takes place in every portion of the system, heat is evolved, *i, e.* hidden or latent heat has become tangible heat.

Without knowing the precise nature of heat, this language is far from being definite, in fact, contains no idea of the process it attempts to elucidate. This indefiniteness and uncertainty disappears the moment we introduce ætheria as a constituent element, and the whole process is clear to the mind. In the scale of existence, materia is elevated with every accession of ætheria as a constituent element till it passes from the mineral to the vegetable, and finally reaches the highest and most delicate organism in man. Heat, as before stated, is simply ætheria in a state of intense vibration. The moment these atoms combine with any form of materia, their vibrations cease, and, of course, the heat disappears, nor can the vibrations again commence as long as this compound remains intact, but the moment it is broken up from any cause, ætheria is liberated in an intensely-vibrating condition, which constitutes heat.

We therefore receive ætheria into the system in the food, in a quiescent, combined state, as an elemental constituent of the food; but as assimilation or nutrition takes place this food is broken up, a small part being used to build up the system, but by far the larger portion is eliminated in its more stable form, as carbonic acid, water, &c., thus liberating ætheria in every point of the system in its intensely vibrating condition, or in other words as heat.

These generalizations are no less interesting to the Pathologist. All inflamation originates in an excess of heat—its other characteristics follow. From what has been said, it will readily be perceived that this heat must come from an abnormal degradation of some tissue as the prime cause. No provision being made to remove this vibrating element, a diseased condition follows.

The application of cold water to gunshot wounds disposes of the excess of heat caused by the degrading process in the region of the injured part.

In general terms, if this generalization be true, inflamation, in whatever of its multitudinous forms it appears, can only be subdued by arresting the degrading process at the seat of the disease.

Illustrations of the application of these generalizations might be multiplied to an indefinite extent, but I designed only to revert to some of the prime principles on which our profession rests, that you, gentlemen, in the prosecution of your studies and research, may extend the domain of known truth, honor your profession, and benefit mankind.