

An introductory lecture on phosphorus : delivered in the University of New York, session MDCCCXLVII-VIII / by John William Draper.

Contributors

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Draper (Jno. W.)

NEW YORK UNIVERSITY—MEDICAL DEPARTMENT.

AN

INTRODUCTORY LECTURE

ON

PHOSPHORUS,

DELIVERED IN THE

UNIVERSITY OF NEW YORK,

SESSION MDCCCXLVII—VIII.

box 3,

BY

JOHN WILLIAM DRAPER, M. D.

PROFESSOR OF CHEMISTRY.

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D.C.

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1847.

THE HISTORY OF

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NEW YORK, November 4th, 1847.

PROFESSOR DRAPER,—

Sir—At a meeting of the Students of the University Medical College, held yesterday, November 3d, H. McNEILL of North Carolina being in the Chair, and O. L. BARNES of Georgia acting as Secretary, it was unanimously

Resolved, That a Committee be appointed to request of the several Professors a copy of their Introductory Lectures for publication.

We, who have the honor to constitute the above Committee, would, in behalf of the Class, respectfully request a copy of your able and eloquent address, delivered on the evening of the 30th ult.

With great respect and esteem, we are, yours, &c.

F. A. STANFORD, <i>Georgia.</i>	LEON D'ALVEAR, <i>South America.</i>
G. T. ELLIOTT, Jr. <i>New York.</i>	W. W. HARPER, <i>Louisiana.</i>
W. A. HAMMOND, <i>Pennsylvania.</i>	ELIHU EDMUNDSON, <i>Tennessee.</i>
J. S. STIGER, <i>New Jersey.</i>	A. HALLETT, <i>New Brunswick.</i>
J. R. SLAUGHTER, <i>Alabama.</i>	W. J. RUTHERFORD, <i>Jamaica.</i>
M. WHITAKER, <i>North Carolina.</i>	W. WALLEN, <i>Florida.</i>
N. A. CHAPIN, <i>New Hampshire.</i>	J. T. M'LEAN, <i>Mississippi.</i>
H. BURGESS, <i>Connecticut.</i>	L. D. SHEETS, <i>Maryland.</i>
H. B. C. HARRIS, <i>Virginia.</i>	G. W. PEER, <i>Arkansas.</i>
E. W. H. BECK, <i>Indiana.</i>	W. H. DIAL, <i>Texas.</i>
C. McKNIGHT, <i>Rhode Island.</i>	J. POSTON, <i>Kentucky.</i>
W. G. HATCH, <i>Wisconsin.</i>	A. C. DEANE, <i>Massachusetts.</i>
J. G. BUCHANAN, <i>Ohio.</i>	G. L. JONES, <i>Vermont.</i>
R. L. CRAWFORD, <i>South Carolina.</i>	W. K. FRENCH, <i>Maine.</i>
J. M. OGDEN, <i>East Canada.</i>	A. S. PETIT, <i>Illinois.</i>
E. PERRY, <i>West Canada.</i>	

By order of the Committee,

O. L. BARNES, *Secretary.*

UNIVERSITY OF NEW YORK, Nov. 6th, 1847.

To Messrs. F. A. STANFORD, and others
of the Committee.

Gentlemen,—I have to acknowledge the receipt of your letter, asking for publication, in the name of the Medical Class, my Introductory Lecture.

It gives me great pleasure to comply with this request, and to offer you my best wishes for your present and future prosperity.

Yours truly,

JOHN W. DRAPER.

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LECTURE.

GENTLEMEN,—

YOU have heard from my colleagues each night this week those customary laudations of their various subjects, which now-a-days form the staple of introductory lectures. After such a display of talent, and abundant provision of intellectual entertainment, I feel that there remains but little for me to do. You have been seated at a series of banquets; the provisions are exhausted, and you are satisfied. I have now the difficult task of entertaining guests without appetites, and nothing but crumbs and bones to offer.

The French, who are a very gallant and ingenious people, some time ago invented a machine, in which, if you put what is left at the table and expose it to a pretty high pressure, a chemical change takes place, and there comes a soup of delicious fragrance and taste. It appears to be immaterial what the original articles are. Ill-natured persons have reported that the city of Paris furnishes many of more than doubtful nature, but all agree as to the excellence of the resulting product.

Now in this is my hope. If I can only catch a little of the inspiration of that illustrious philosopher who made the contrivance in question; if I can only raise the steam as high as he gets it in his digester, perhaps out of the refuse with which I have to deal, I may concoct a compound somewhat like his, and gain your applause, if not for the internal excellence of the thing, at least for the merit of the attempt.

And, talking of bones, as I have metaphorically alluded to them, I don't know that I can do better than actually take them for our evening's entertainment. Some of you may very naturally say,—What in the world have you to say about them? It is the duty of the professor of surgery to set them, and the graceless world says it is the duty of the professor of anatomy to steal them; but what can a chemist have to do with them?

Sometimes things which are very dissimilar, come to be singularly connected together. This observation holds good as to the nature of bones and the making of gold. Three hundred years ago it was believed by all philosophers, that a method might be found of turning lead and other base metals into gold. The pursuit of wealth seems to be the natural instinct of man; nor is it so debasing as poets and moralists would have us believe, for the possession of money is the possession of power. In all countries, and in every age, the daily avocation of the human species has reference to this object mainly. Some find it

by dint of perseverance and toil ; some in a swift manner, by cunning manœuvres. The Alchemists hoped to discover some simple method of turning all substances into the precious metals ; to discover the powder of projection and the philosopher's stone, which were supposed to possess that virtue, was the object of those artists. You will read in the books of medicine, that at periodic intervals great epidemic diseases make their appearance and sweep over the earth. In one age it is the small-pox, in another the Asiatic cholera. And, in like manner, periodic illusions affect the human race ; now it is the belief in witchcraft, and now in the making of gold. The multitudes of visionaries who spent their lives in the pursuit of this latter art, and whose success in their times was vouched for by many credible witnesses, this unbelieving age denounces all as impostors ; a sad commentary on the validity of human testimony ! And yet there were successful alchemists, Cortez, Pizarro, and their cotemporaries. The mountains of Mexico and Peru were the true philosopher's stone ; and gunpowder, in a double sense, was the powder of projection.

In this age of physical miracles, one is tempted to ask,—Will the dreams of those victims of delusion ever be verified ? It has long been the custom of literary men, who are commonly profoundly ignorant of any thing like exact science, to hold up the maxims of alchemy to popular derision. But we have seen much more unlikely expectations realized, and unquestionably the present tendency of chemistry lends support to its views. Of sixty elementary substances, more than forty are metals, and many of them are so nearly alike, that expert chemists are often puzzled to tell the difference between them. Does any man, who has a proper appreciation of the universal simplicity of Nature, suppose that God has made so many elements that are indistinguishable ? Is there any thing laughable, or unphilosophical, in supposing that they are either modifications of one another, or perhaps all compounds of two or three more primitive forms ? It requires some little degree of moral courage to present the facts as they actually are, and stem the derision of the conceited and ignorant ; but the metals will one day be transmuted into one another, and the dreams of the Alchemists all realized.

To find a substance which should thus turn lead into gold, every conceivable, and many an inconceivable object was exposed to the processes of chemistry,—levigated, elutriated, cohobated, distilled, sublimed. Nature was tortured in a thousand different ways, but like some of the political martyrs we read of, neither the fire nor water could wring her secret out. In operating on one of the products of the human body, an alchemist discovered a waxy substance which possessed the astonishing quality of shining by itself in the dark, catching fire and burning furiously when touched, and then exhaling a smoky fume which coalesced in flakes exactly like fleeces of snow, but, unlike snow, hissing like a red-hot metal when touched with water, and if permitted to come in contact with the body, burning it like a coal of fire.

Here was something, which, if it could not fix lead into gold, was very well calculated to fix the whole fraternity of Alchemists with amazement. In that age of superstition, many came to the conclusion that

this was a veritable incarnation of the principle of evil. Whether more of it could be distilled out of a bad man than a good one, does not clearly appear; but, as expressive of its supposed nature, the mysterious body passed under the name of the "Son of Satan." Small portions of it, kept in bottles filled with water, were circulated among the initiated. It would soon take fire except beneath that liquid, and the devout alchemist was often edified in his laboratory at night, by the shining and sparkling of this mysterious substance.

Some eminent authors believe that the full development of the poetic temperament is only possible in a state of ignorance. This substance, which excited such a profound awe in the breasts of its ignorant discoverers, is that same phosphorus with which school-boys play tricks on one another in our times; grotesque figures may be drawn with it on the wall, which glisten with a fitful splendor in the dark; and dissolved in liquids, if it be put on the temples, they shine with a lambent flame which mimics the halo that you see round the saints, and is equally substantial with that glory which is said to surround the brows of conquerors and kings.

Towards the end of last century, a Swedish chemist discovered that this body is an essential constituent of the bones, in which, under the form of phosphoric acid, it is united with lime, constituting the phosphate of lime. Soon after, it was also found to be uniformly present, in an unoxidized state, in the brain and nervous matter generally.

Now, perhaps, you begin to discover that our subject is not quite so void of interest as appeared at first. It attaches itself to the curious history and wonderful properties of phosphorus, an element which not only enters into the construction of the skeleton, but is an essential ingredient of the brain itself. A substance which has thus, as it were, to stand in the very presence of the mind, may well borrow a glory from its exalted position. It is fitting that it should shine in the dark. That property is typical of its physiological destiny; of the function it is called to discharge.

At a remote period, agriculturists found that, in many cases, pulverized bones constitute one of the most fertilizing manures. Luxuriant crops might be reaped from fields so treated, and to lands worn out and exhausted the original fertility might often be restored. Observation showed that the various corn and other plants which grew in these places, abstracted this manure from the land; and by their processes of growth, the phosphate of lime, or bone earth, was eventually stored up in the seeds. By an unerring instinct, animals and men are led to seek for these as articles of food, and indeed, life cannot be supported except on things that contain the phosphate of lime.

Ah! here now is a beautiful fact. There is then a link between the vegetable and the animal world. The plants are collecting even mineral food for us out of the ground. To make a bone, see how many wonderful things conspire! Those tribes, under the influence of the sun and the rain, are diligently at work; their roots are busy in every crevice of the soil, looking for the little particles; and man, as if he were the child of destiny, is impelled by an instinct to cherish those which do this best as his proper food. Instinct! is not that Nature think-

ing for us? And all this machinery of physical forces is necessary for the fabrication of a bone!

But you will say, the fields must at last be exhausted, and plants fail to discharge their duty. You forget the inexorable condition under which life is enjoyed, that is only for an appointed time. The various parts of the animal system are hourly perishing; and, finally, by the act of death, all are restored again to the inorganic world from which they came. If the flowers of the field live for us, we die for them; their destinies are interwoven with ours; the existence of one ministers to the existence of the other. With what a charm do these considerations invest surrounding objects; they deepen our thankful feelings for the gathered fruits of autumn, and add an air of melancholy to the falling of the forest leaves.

But see how they bring us in connexion with those old times of which the Scriptures speak, when "there was no man to till the ground." They who have read the book of Nature know well that the entire crust of the earth is made up of the remains of things that have once lived; that strata after strata reveal the strange forms of many tribes of life that have now become extinct. There have been fishes, and birds, and beasts, thousands of species of which have disappeared, and their skeletons are entombed in the rocks of those primeval times. Some artificial or natural cause disinters them; the ploughshare breaks them up; and after a sleep of thousands of years they come into the cycle of life again. What a change between their last appearance as part of a living system and the present times! Then the world was a waste, howling wilderness—a hot sun shone even in the polar regions, and enormous lizard reptiles hid in the rank tropical vegetation. That was a period when brute force had the mastery, but now intellect has asserted its sway, and civilized man has become the ruler of the scene.

I have told you that phosphorus is an essential constituent of the bones of animals; I have related the history of its discovery, and mentioned some of its chemical qualities. It is only a moment since we were introducing the subject of our evening's consideration in a playful way, and here we are in contact with the ancient, the mysterious, the awful. For what human considerations are better entitled to these epithets than the relations of life and death? Already new thoughts are occurring to us all; the glimpses of great truths are presenting themselves. To those who have never realized the tendencies, or known the views of modern science, the whole world presents at once a different aspect, the very face of nature changes, and you have learned, since you came into this room, that there are connexions in which you stand, and of which you never dreamt.

But this is not all. This wonderful element, phosphorus, has higher duties to discharge; it is destined for greater things. Plants furnish us not only the phosphate of lime, but also phosphorus itself, in an unoxidized condition. The recent progress of chemistry has shown that nearly all elementary substances can exist in two different states; in one, they are as it were torpid, their activity is lost, they exert none of their usual powers; in the other, those powers are all put forth. These passive and active conditions go under the name of allotropic

states. You see them exemplified in the case of carbon; the diamond, which is its passive form, can scarcely be made to burn in pure oxygen gas; lamp-black, which is one of the active forms, is so prone to combustion that it will even take fire spontaneously in the air. These peculiarities attend bodies when they go into combination; of this I shall give you an example this winter; you will see active phosphorus, in union with hydrogen, catching fire, with a splendid flame, on coming in contact with the air, and the same compound of passive phosphorus totally devoid of any such property.

Under the influence of the rays of the sun it is the function of plants not only to obtain free phosphorus from the phosphate of lime, but also to throw it into the passive state. It is then consumed by animals in their food, and associated with hydrogen and carbon, forms those phosphorized oils which are characteristic constituents of the brain and nervous matter. It passes through the intricate vessels of the body; and, though bathed in arterial blood, is not oxydized by it; and is at last deposited in the vesicular portion of the nervous matter. In this quiescent state, it awaits to perform its grand function. It is, as it were, fallen asleep, but is ready to be awakened by a touch. In the twinkling of an eye, under the influence of the mind or the will, it is oxydized at given points by the arterial blood; heat and phosphoric acid are the result, that same phosphoric acid which I have heretofore described as having such an intense affinity for water. But how skilful a chemist is nature; the very same process which gives rise to the phosphoric acid, simultaneously sets free ammonia, by which that corrosive body is neutralized, and the double phosphate of soda and ammonia results; and this is removed from the body, and is restored to the inorganic world again, ready to run its race once more through the systems of plants.

No intellectual operation can take place, except it be attended by the oxidation of phosphorus; and according as it is more vigorous and prolonged, so is the amount of that oxydation greater. The man who breathes vapor of ether, and thus partially prevents the arterialization of his blood, necessarily puts a check on this chemical change, and for the time being he ceases to have a clear perception of things; he becomes insensible to the most terrible operations of surgery. On the other hand, the man who breathes the protoxide of nitrogen, over arterializes his blood. In the interior of his system all oxydizing processes go on at an accelerated rate; a feverish glow overspreads him, a thousand delightful visions pass before him, he lives a year in a minute, and that year is in the seventh heavens.

Do not, now, misapprehend what I say. I would not have you suppose that intellectual operations *arise* in material changes. The fact I am pointing out is, that in the action of the mind on external things, chemical changes *intervene*. We all know that no mental operation can directly exert any mechanical effect. No volition of ours, no matter how strong it may be, can ever lift a stone from the ground. It is through complicated organs that the mind acts; there is a lever-like arrangement of bones, which is set in action by the contractile power of muscles, and these, in their turn, by the nerves. In this chain of physical

events, intervening after the primitive action of the mind, the oxydation of phosphorus bears an essential part.

It seems to be a law of nature, that the intellectual principle neither acts upon the external world, nor is acted upon by it. A double system of contrivances is resorted to, which stand in an intermediate relation to the material world and the immaterial part. Through the eye, the ear, and the other organs of sense, we gain intelligence of passing events. Through an equally elaborate system of organs our actions are expressed. And though it does not enter into the compass of the physical sciences to encroach on the regions of intellectuality, yet, to investigate the origin, the nature, the mode of action of these intermediate organs, belongs to physiology and philosophy, and on these very points, the most splendid discoveries are being made. It belongs to optics to examine the construction of the eye, to acoustics that of the ear. It is the province of chemistry to reveal the nature of the changes going on in all parts of the system.

Your anatomical studies will teach you the character of these intermediate organs. They will, for instance, set forth the parts of the eye; its coats, its humors, its lens, and how the nervous expansion of the retina is connected with the brain by the optic nerve. But it belongs to physics and chemistry to commence where the anatomist ends. He describes the parts, they tell the use. They show how the images of external objects form, on optical principles, on the dark pigment, and how, under this influence, the nerve globules of the retina are oxydized by the arterial blood, which, through thousands of vessels, finds its way all over the choroid coat. How, wherever this oxydation goes on, the temperature rises, and the optic nerve transmits the impression to the brain; and we thus discover, that though in a certain sense the action of that nerve is special, yet in reality it is like that of any other sensory nerve, which, in like manner, transmits the impressions of heat. A pleasurable sensation within certain limits, and painful when in excess.

So, too, the anatomist describes to you the bony skeleton, and how it is covered with a coat of muscles; how these are in relation with the cerebro-spinal axis, through the intervention of nerves. He, perhaps, points out to you the mechanical adaptation of the muscles and bones to one another, and shows you their lever-like action. But there he stops. Again, it belongs to physics and chemistry to take up the story, and to explain how every motion must be accompanied by, and indeed originate in chemical changes occurring in the nervous machinery.

Doctor Syntax, a man whose name is connected with many pleasant recollections, encountered an incident which will put this doctrine of intermediate organs in a proper point of view. He was troubled one night with an incessant rapping of the knocker of his door, and though he went repeatedly and opened the door suddenly, and even watched from an upper window, no human or material form was visible. At first he was led to refer the affair to some supernatural agency, a visitation of goblins or spirits. But relying on the philosophical fact I am now pointing out, he concluded that a ghost could neither beat at a knocker, nor ring at a bell, and, on a more critical examination, discovered a thread, the fur-

ther end of which was held by some of his graceless scholars on the other side of the street.

If you ask some men to show you the noblest object that can occupy our attention, they point to the heavens; and, surely, when we consider the number, the distance, the magnificence of those flaming suns, they may well be regarded as the types of infinitude and eternity. But say, you who are anatomists and lovers of philosophy, can that gorgeous spectacle in reality compare with the brain of man? That is the masterpiece of God. Those suns and their attendant planets, execute their intricate motions in passive obedience to one simple law—the law of gravitation. Magnificent as it is, it is all mechanical. Can such things compare with the brain, which, in the compass of a single span, contains the springs of whatever we do, and receives the impressions of whatever we experience? In this laboratory of wonders have originated all the great crimes which deform our species, and all the illustrious acts which are our glory. If you are astonished that the sun, millions of miles off, can control the movements of a circling planet, is it not a matter of greater amazement, that this small organ shapes events that are to happen a thousand years after it has ceased to exist; for, are not religion, law, science, civilization, the offspring of the past? The past! has it not surrendered its secrets to our keeping, not only through the means of historical recollections, but, overleaping the date of our own creation, have we not penetrated into those hidden times which witnessed the first dawn of organization on this earth? In the unfathomable abysses of the universe, where star after star in succession is lost, we find a resting place, and comprehend the distances, the magnitudes, the times, of those revolving orbs. The cerebral matter receives in its plastic substance the minute representation of that majestic universe. Nor is the eye alone its minister, but also every organ of sense. The sounds of music that float in the air, depict their shadowy forms upon it; and, after the lapse of years, suddenly present themselves, often on the slightest cause, and the voice embodies them again. The brain is also the storehouse of all our recollections. In its windings there are the voices of those we have loved. The phantoms of the dead sit in its mysterious vaults. They wait until memory orders them to come forth to revisit the scenes through which they have passed. How often in prosperity do they extend a warning; in adversity they are our guardian angels; they attend us in the busy scenes of life, and are our companions in solitude. Even now, the voice that addresses you recalls, at once, in this, his late appropriate sphere of duty, the kind instructor* we have lost; and to those of you who, in former years, here listened to the lessons of wisdom that fell from his lips, the accustomed walls seem to re-echo his feeble but earnest words. Imagination brings back the well remembered and benevolent countenance, and all the recollection how upright and merciful he was. And, gentlemen, is it not well that Providence has so ordered our lot, that though, in the decline of life, one sense after another may fail—the eye no longer see, the ear no

* Professor John Revere, M. D. died at the close of the winter session, 1847.

longer hear, and perception become obscure; the mind still keeps fast its early and holy remembrances, and thus can bring back from the land of shadows those that are gone, and recal to life the dead.

In what an impressive manner do these things proclaim the dependence of all orders of nature on each other. Here, where we should least expect it, we discover the blending of the material and the immaterial worlds. Those instruments which must of necessity be furnished to the mind before it can be put in relation with the world, are themselves dependent for their existence and preparation on physical causes. The shining of the sun and the due return of seasons, the germination of plants and the ripening of fruits, are steps essential to the grand and mysterious relationship which man maintains with the universe. To be told by the anatomist of the design and adaptation of the bony skeleton may excite attention; and chemical researches, such as I have related, which reveal the singular properties of the constituents of which its earthy matter is composed, may gratify our curiosity. But when we pursue these facts to their consequences, and look with a philosophical eye at each step in the chain of events, he must be stupid indeed, whose admiration is not at once called forth. To see the vegetable world, silently engaged in extracting from the soil mineral matters; and the sun decomposing and arranging those products; and animals led by their instincts selecting their food,—some for the support of their respiratory process—some for the production of motion—some to be consumed in intellectual acts. Is it not fitting that in the production of such results, the sublime and the beautiful should both join? and that passive phosphorus, on which the mind first impresses its action, should owe its birth to the sun, and be rocked asleep among flowers? A dry bone! what can be said about it? Aye, aye, but the dry bones are now beginning to live; and thus it is ever with truth, it can extract splendor from the unvalued and unknown, and shed a glory over desolation and decay.

I have already told you that all the phosphorus which is contained in the bodies of animals, is derived from the deoxydation of phosphoric acid taking place in plants. To those who are beginners in chemistry, it may be told that it is through the addition of oxygen, one of the elements of the air, to phosphorus, that it becomes converted into phosphoric acid. In this point of view it is, therefore, the office of plants to take away its oxygen from that acid and set the phosphorus free. I have also stated that precisely the reverse takes place in animals, in whose systems the phosphorus again becomes oxydized, and goes back to the acid state. In these singular phenomena we see the relations which the great kingdoms of nature bear to each other; it is that of antagonization. The one reverses what the other does; and the material particles vibrate, as it were, from one state to another; now they are occupied in plants, now they are active in animals. It seems to be a law of the material universe, that periods of revolution are observed; each planet has its fixed time of rotation on its axis, and a time for its translation round the sun; the seasons return at stated intervals; the sea ebbs and flows; the moon waxes and wanes. Even in the case we are now considering, the same law holds good; the passages from

state to state are so arranged that they return in a circle to their starting point. The same material belongs in succession to the mineral, the vegetable, the animal world; and then it drops back to the mineral again, to run its cycle once more. An unphilosophical observer may not notice the result. Things appear to him to be in a steady progression, straight-forward in a course through which they never return. He will admit that the particles of which animal structures are composed, are derived regularly from the inorganic world, but fails to see that, over and over again, they run through the same series of events; just as the sun by travelling continually west, gets round to the east every morning.

If thus the oxydation of phosphorus is the first part of this mysterious chain, how abounding in interest it would be to exhibit each one of the successive links. How awful to turn the other way, and look upon the agent who, as it were, by enchantment sets all this machinery in motion! We go through the labyrinths of her palace; we visit her chambers; the silent, but presiding genius is unseen. As Tacitus says when Pompey broke into the holy of holies at Jerusalem, "There is no image of a Divinity within; the shrine is empty; the recesses vacant." In vain, after death, by their dissections and analyses, the anatomist and chemist explore the empty passages; there is the eye through which she looked; the ear that gathered the sounds of voices; the vocal organs by which she conversed with her fellows; the heart that fluttered with her joy; the cheek that crimsoned with her shame. The habitation is still in order; all the furniture, all the machinery is there; but the veiled enchantress is gone.

Of that intelligent but accountable being, by whatever name it may be called—soul, spirit, mind—it is neither my office nor purpose to speak. And yet I may, without offence, point out the province of human discovery, and show where human science ends. There is no gradual shading off, no softening of the light into darkness; no passage, little by little, from matter to spirit. The two have separate existences, separate destinies, and separate durations. They are divided by a great and impassable gulf.

A century ago it was the custom to divide a discourse into numerous heads, each presenting some new feature of the subject. There have been zealous preachers, whose sermons ran as high as seventeenthly, eighteenthly, nineteenthly; and in addition, they had finally, lastly, in conclusion, and once more. With these, it is not my purpose nor pretence to compete. It is only a single view of a very common subject I have set forth, and that done, I hasten to the end.

But the great feature of that view I wish to fix indelibly on your minds. I wish you to see, clearly, the charm there is in philosophy. How even the commonest objects can be invested with interest, and how, seen by the light of science, things entirely change their relation to us. Man in a state of ignorance believes that independence is a state of happiness, but educated man knows it is an impossibility. The conditions of our existence are such that we are tied by destiny to every object. Even in our most lofty pursuits, we depend on events in themselves contemptible. Not only does each of us hang on the assistance of

all the others, but we are what we are, and where we are, because of influences to the unphilosophical eye vile or insignificant. Nor are the highest relations we discharge exempt from that rule. Never forget that the thinking of a man and the growing of grass are closely connected. And in their effect upon the mind, what a change do these considerations bring all over nature! Associations spring up where before there was no connexion, and every thing around us assumes a different aspect and brighter color, for it has become part of ourselves.

It is an observation which applies equally to the history of a world, or a nation, or a man, that for a certain period things run on in a quiet course, and each day seems scarcely to differ from the preceding, and events pass forward monotonously. At last, on a sudden, a change occurs, an epoch has arrived. Thus for centuries together, this globe of ours, as we see in our times, held on its quiet way; then some catastrophe overwhelmed it, and a new order of affairs arose, to be changed again and again by similar periodic recurrences. At separate intervals it has witnessed a scene of fire, floods of water, an age of reptiles, the predominance of great quadrupeds, and last, the appearance of man. So, too, in the history of our race, one nation has passed away after another, though each in its day, and among its cotemporaries, may have appeared to be imperishable; one after another, great wars or great discoveries have shifted the scene. So also in the life of a man, day after day events pursue their silent course, and things seem to be as though they never would change; at last an epoch comes, and life assumes a new aspect.

We all observe how much these varied events depend upon accident; how little a man can tell what is waiting for him in the future. Uncertainty casts its shadow over the most brilliant periods of our life. Even the most adventurous man may pause when his epoch has come.

I never meet a medical class on the occasion of these introductory addresses, without indulging the thoughts I now utter. The consideration may surely interest us, for here are collected several hundred individuals whose course of life has come to its point of change. You have now new objects, new pursuits, new interests, new affections. Exposed to all the seductions of a great and dissipated city, many of you are left standing alone for the first time, with no parental eye to watch or tongue to warn. And even those whose maturer years and intercourse with the world have taught lessons of caution, can you look back to the past and then to the future without an anxious interest? How little an event may alter the entire complexion of that future, and make it brilliant or dark!

To men in your present position, what greater preservative can there be from such risks than an unremitting application to study, and what incentive to that application is there so great as a love of knowledge? It is for this that I have endeavored to awaken in you a perception to the beauties of science, and if what you have heard should by chance, through its indirect influences, call forth in any of you good determinations, we shall recall our first meeting this evening as a time both of pleasure and profit.

