Draper (Jno. W.)

NEW YORK UNIVERSITY--MEDICAL DEPARTMENT.

INTRODUCTORY LECTURE,

TO THE

COURSE OF CHEMISTRY:

DELIVERED BY

PROFESSOR DRAPER,

ON THE

RELATIONS OF ATMOSPHERIC AIR

TO

ANIMALS AND PLANTS.

SESSION MDCCCXLIV--XLV.

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New York, November 4, 1844.

Prof. Draper:

Dear Sir:—At a meeting of the Class of the University Medical College, held on Saturday evening last, Mr. S. S. Satchwell, of North Carolina, being in the chair, and Mr. Edmund R. Dabney, of Tennessee, acting as Secretary, on motion, it was unanimously

Resolved—That a Committee be appointed to solicit for publication, a copy of the able and eloquent Introductory Lecture delivered this evening by Prof. Draper.

The undersigned having been appointed the Committee to perform this pleasing duty, allow us to add our individual wishes to those of the Class, and to hope that you will not refuse so unanimous a request.

We need not assure you how truly we are yours, &c.,

Philip A. Aylett, *Alabama.*
William J. Alexander, *Virginia.*
Cyrus Arndt, *New Jersey.*
John M. K. Alford, *North Carolina.*
John W. Albury, *West Indies.*
W. A. Burleigh, *Maine.*
J. Brown, *New Hampshire.*
E. T. Currie, *Maryland.*
G. W. Clippinger, *Pennsylvania.*
R. H. Clarke, *Delaware.*
Oliver Crooks, *Ohio.*
William Edwards, *Mississippi.*
G. G. Gaither, *Kentucky.*
W. M. Huntingden, *Vermont.*
B. S. James, *South Carolina.*
John McGregor, *Rhode Island.*
Charles T. Mount, *Canada.*
Valentine Mott, Jr., *New York.*
Edward Perry, *Connecticut.*
George W. Parkhill, *Florida.*
Wm. M. Ryer, *Illinois.*
J. B. Selby, *Wisconsin.*
George M. Tutt, *Georgia.*
T. D. Washburn, *Massachusetts.*
D. E. Warren, *Tennessee.*

New York University, Nov. 7, 1844.

To Messrs. Aylett *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, a copy of my Introductory Lecture.

It would be needless for me to tell you how much pleasure it gives me to comply with your request, and how deep an interest I feel in the prosperity of each member of the Class, who may listen to my instructions on these subjects this winter.

With sentiments of esteem, believe me,

Yours truly,

JNO. W. DRAPER.

LECTURE.

To assign plausible causes for natural events is the object of superficial men, to find the true ones is the aim of philosophers. Whether it be in the infancy of society or in the infancy of an individual, a readiness is always manifested for giving an answer to every question in literature, in science, in statesmanship, in theology; and it is only after our explanations have reached a certain degree of precision, and their bearings on one another are discovered, that we begin to modify our general views, or perhaps to reject what seemed the most palpable of our first suppositions. It is one of the leading characters of ignorance to be full of knowledge. In the beginning of life there seems to be nothing beyond the compass of our intellectual apprehension, nothing too great for ambitious exertion, but as time wears away, and the phantoms of youthful imagination disappear, we learn to distrust our mental powers, and prescribe a narrow boundary for the things we expect to attain. Realities in society, and events in philosophy, undeceive us at last; and there steals over the evening of our days an unwelcome conviction of the greatness of human vanity, and the littleness of human knowledge.

If these things are to be observed in individual history, they are still more strikingly developed in the progress of mankind. When civilization was in its infancy a clear account could be given of every natural phenomenon, and problems in any department solved and rendered plain to a feeble capacity. But with the progress of acquirement these ancient explanations have been one by one rejected. Only here and there a trace of them remains. Men have discovered, that so far as human intellect is concerned, the ways of Nature, instead of being simple, are intricately complex. There are questions in law clear to the client, but doubtful to the lawyer; doctrines in theology plain to the zealot, but disputed by the churches; affairs in politics for which a demagogue may rave, but from which a statesman will shrink. And so it is in science: in early ages men saw that every thing was plain, but now they believe that all things are obscure.

In every science an increase of the extent of knowledge brings also an increase in the boundary of surrounding darkness. At the most it is but a little way that we see, and as no man can estimate the amount of what is unknown, neither can he estimate the full value of what we have acquired. All the old great discoveries which have exerted so powerful an influence on our race, have long ago, by reason of their commonness, ceased to attract our attention; and we are led to undervalue the greatest facts, because they no longer possess a charm of novelty. The characteristics of the human mind are for ever the same; whatever is unknown or mysterious exerts over us a

powerful attraction ; whatever is newly discovered excites our curiosity or perhaps our admiration ; whatever is old we neglect or pass by. Thus for thousands of years, in men of all countries and of every faith, the thunder storm excited awe, and the lightning was looked upon as shot from the right hand of God ; but we live in a day when school boys bottle it up in Leyden phials, and administer it to one another by way of a joke.

We have reached a period in the advances of science which is destined to be fruitful in many of the most striking and marvellous discoveries,—the relations which subsist between living creatures and the inorganic world. In this, many of those mysterious impressions which men in all ages have held, are destined to pass away ; and in their stead there will be replaced those more perfect and more beautiful views which arise from exact knowledge. It is the attribute of modern science that it gathers around it all those poetical feelings and forms which arise from whatever is far-reaching and true. There is a creative quality in the human mind which calls into existence things that are new, and fashions in novel combinations things that are old. To these phantoms a duration can be given which far exceeds that of the material objects of nature, and the multitude of them which exists constitutes the unreal but eternal word of literature. The fictitious events with which the genius of Homer has surrounded the Trojan siege, or the adventures of Ulysses, will last for ever. When, in the course of thousands of years, those slow but unceasing geological forces which alter the face of continents, which dry up rivers, which give inroad to the waters of the sea, and make new regions from its oozy bed, shall have utterly removed all traces of objects which in former days the landscape revealed, still, in the imagination of the scholar, Scamander will roll his waters, and the laughter and revelling of the Suitors will still re-echo in Ithaca. And if these are the results of the human mind operating on objects that are in themselves insignificant, what are we not to expect when the subject of its contemplation has risen into an awful magnificence, and stands in relation to the world of life and death, the course of animated forms, and their connexion with inorganic things.

During the past summer, in preparing for the press a work which I have recently published on the Chemistry of Plants, my thoughts have been forcibly turned to these things. The inorganic and the organic world are blended together, depending both of them on common laws. From the atmospheric air which is around us the vegetable world comes into existence, under the influence of that arch magician the Sun, and on the resulting organized forms animals find their proper food. The operations of that distant star, therefore, furnish food for man—food of which his living structures are formed ; and these, during the course of life, and by the act of death, are broken down, and their constituent parts are restored to the air again.

If thus the vegetable world springs from inorganic gases in the air by the light of the sun, and is destined to afford nourishment for the various tribes of animals,—what, then, are they ? The processes of destruction which are constantly going forward in the animal frame—the constant carrying away by respiratory and other functions, which

are in action night and day—the constant introduction of new matter in the form of food ;—there is no motion that I execute—this finger is not lifted—this voice does not make itself heard, without the destruction of a given weight of organized material, a destruction which is essential to the production of a given amount of force. In a steam engine, by which a given quantity of work is to be done, a given weight of coal must be burnt. It is in the transmutation of particles from one condition to another that physical forces arise ; and all the movements that I 'execute, all the powers that I exert, originate in the passing of particles from the organic to the inorganic state.

Do not, therefore, these things invest the commonest phenomena we witness with superabundant interest ? The act of breathing ceases to be the escape of noxious gases from the lungs. The particles of which those gases are composed, are passing from the living state into the condition of death, and this atmosphere which is around us, presents itself as made up of crowds of atomic forms which have been expended in the production of every kind of movement and change. In the few years that have elapsed since I came into the world, I have thrown into that atmosphere more than sixteen tons weight of matter which has circled in these veins ; and I am only one of myriads of living things.

As thus these particles are removed from animated systems, and dying escape away into the atmosphere, they shall leave behind them marks of the offices they have performed. Their migration from the living to the dead state has been for the production of force—force which has been expended in procuring for me all that might subserve to animal pleasures or gratify intellectual desires. This enormous destruction of material has left its impression behind,—impressions that are not perishable in their nature, but last till the close of life. Whatever, therefore, I have learned from the experience of years, or from the education of youth, whatever I have gained by exertion, or lost in the course of events, has left a permanent impression, and it is in these things that individual character arises. Though there is a daily change of organized structure, the consciousness of personal identity remains.

Whilst, then, this body has ceased to be composed of the same identical parts which entered into its constitution a year ago,—for those have passed away into the atmosphere, and new ones have taken their places, and processes of destruction and renovation have been accomplished ; these unceasing changes have left no impression on, and done no injury to the intellectual principle within. In an instant, and spontaneously, there come to recollection words which I have heard in early life, which have been registered on the tablets of the brain, and in dreams at night as well as during the business of the day, there arise before me long forgotten forms of scenery that I once beheld, the remembrance of transactions in which I have borne a part. Do not then these noble discoveries of modern Chemistry impress on a reflecting mind a deep and absorbing lesson ? If, in the midst of all this mutation and change, this hourly escape of dead atoms by respiration and other processes, this constant re-introduction of new matter in the form of food, and its transient continuance as a part of a living

mechanism, there still remains behind an intelligent principle with all its affections and feelings, and acquisitions and knowledge unaltered and untouched,—do not these things declare plainly, that after the act of death shall have utterly broken down and dispersed and dissevered the parts of this organized frame, there still shall remain that same intellectual principle unscathed,—still bearing the impression of whatever it has seen, whatever it has done, whatever it has endured!

It is the quality of knowledge in expanding our views to give us new conceptions of things which are around. To those of you who are commencing the study of medicine, who hear for the first time to-night the ideas I am endeavoring to unfold, ideas which the recent advances of Organic Chemistry have taught us, what new associations at once spring up. You leave this room not with mere words jingling in your ears, but the possessors of a new, a great fact. This atmosphere, the air which envelops us on all sides, is no longer an inert uninteresting mass through which winds sweep, but it comes forward at once into its true position as the connecting link between vegetable and animal life. As I have said, organized by the rays of the sun, from it are condensed the various vegetable forms which adorn the face of the earth and furnish food for all animal races, and to it there return unceasingly during life, and totally after death, those animal forms. It is the grand receptacle from which all living things spring, and to which they all return. It is the cradle of vegetable and the coffin of animal life. Look also at the sun: even the magnificent views of the astronomer are here surpassed, and that gigantic star no longer appears as a centre or focus of mere mechanical force, who draws up comets from the abysses of space and with an inexpressible velocity precipitates them headlong back again; who afar off watches the revolving planet glide on its elliptic path, or makes the tides ebb and flow in the seas; but he appears as the fountain of light and of life, who spreads in the torrid zone a luxuriant vegetation, and in autumn ripens the harvests for our use; whose many colored rays during the revolving seasons are occupied in fashioning and forming food for us, or evaporating pure water from the sea, or condensing clouds in the sky, which give an air of change and life in those regions of eternal repose.

Philosophers have long ago determined, that light consists of vibratory, undulatory, or wave-like movements which take place in an ethereal medium existing every where. It is a more recent discovery that these vibrations are the first origin of the vegetable world. In the work to which I have alluded, I have given the details of this most interesting connexion. Out of a limited number of ponderable substances such as carbon, nitrogen, hydrogen, oxygen, and a few others, all kinds of organized structures are formed, and there is an extensive machinery to collate and group together these different bodies. Light in itself can produce as many different effects as there are possible combinations of color, for each one of its rays has peculiar powers of its own, and it is also attended by other invisible and imponderable principles which have their modes of action. An organized structure of a given kind is therefore the result of the operation of many of these forces, and is an expression of the aggregate action. In the full development of a perfect tree there has been expended a measured

quantity of forces of light or of heat, and the organized mass as it stands before us is the product of those forces, is the resultant of millions of vibrations of the luminiferous ether, which have acted upon ponderable atoms; vibrations, which have stood in a certain relation to each other, as the symmetry of the vegetable parts indicates. In the operations of human agency something of the same though of a grosser kind may be seen. We have not it is true, the power of calling into existence, or of determining in an enduring shape, or of giving an embodied form to material atoms; but in the same manner that nature, operating through ethereal undulations, creates the various forms of vegetable life, there has been committed to us a control over those grosser undulations which move in atmospheric air, and constitute sound. The imagination, the genius of the great masters of music, have already grouped together combinations of these waves which are destined to an earthly immortality; combinations, which, when once heard leave their indelible impression on the memory, and are to us an embodiment of symmetry and harmony. These ideal creations which exist only for the mind are analogous in very many points of view to those more tangible creations which are formed by ethereal waves and which nature has reserved in her own hands. The symmetrical or beautiful forms which are transmitted to the brain by the eye, appeal at last to that same, that common principle which receives melodious or harmonious sounds transmitted by the ear, and the creations of human genius, whether they be expressed in the language of music or painting, whether they are heard in the Cathedral or seen on the canvass of Claude Lorrain, give us pleasure, because their final impression is made on a mathematical organ, which is so constructed as to appreciate whatever is symmetrical in position, whatever is graceful in figure, whatever is harmonious in movement.

From this point of view, therefore, I look upon the vegetable world as an embodiment of the action of ethereal agents. A tree, when covered with blossoms in the spring, or laden with fruit in the autumn, is a resultant of the play of those active forces which have been emitted by the sun; an expression of what has been done by vibratory movements operating on ponderable molecules. As soon as the young plant has exposed itself to the solar beam, growth rapidly begins to take place, and organized matter to be condensed from the air, and now a green color is developed, and the stem elongates and leaves are put forth. In carrying forward all those multiplied operations which have ended in these events, its leaves and its stem have gone upward in search of light.—light which has symmetrically arranged their parts and furnished their substance. But these general views are far from giving us an accurate idea of the forces that have been expended or the motions which have been executed in producing the result we contemplate. A forest tree, from its magnitude, rising perhaps a hundred feet from the ground, and spreading its branches over hundreds of square yards, may impress us with a sense of sublimity; a section of its stem might assure us that it had lived for a thousand years, and its total weight could only be expressed by tons. An object like this may indeed call forth our admiration, but that admiration is expanded into astonishment, when we come to consider minutely the circumstances

which have been involved in producing the result. If we conceive a single second of time, the beat of a pendulum, divided into a million of equal parts, and each one of those inconceivably brief periods divided again into a million of other equal parts—a wave of yellow light during one of these last small intervals has vibrated five hundred and thirty-five times. And now that yellow light is the agent which has been mainly involved in building up the parts of the tree, in fabricating its various structures, and during every one of a thousand summers, from sunrise to sunset the busy rays have been carrying on their operation,—who then can conceive when in the billionth of a second such enormous numbers of movements are accomplished, how many have been spent in erecting an aged forest oak? Who also can conceive the total amount of force employed from century to century in arranging the vegetation of the surface of the globe?

I therefore regard a planetary body like the Earth, in its orbitual revolution round the sun, as a predetermined focal centre on which the emanations of that star shall be expended, first in producing vegetable organization, and finally in lending their aid to the evolution of animal intellect. The forces which NEWTON revealed, as urging such a body forward, or causing it to glide in its elliptic path, appear only as an incidental though essential part of the mechanism of the Universe, the interest of which disappears in that higher interest which must attach to whatever stands in intimate connexion with organization and vitality. Those many-colored luminous wavelets which are ceaselessly crossing the interplanetary spaces, go forward on an appointed errand and sooner or later discharge their final task; nor are the planets in the solar system a colony of opaque globes rotating without purpose or end around the central attractive mass. The solar system is an orb of movement and light, full of vibrations of every tint visible and invisible, which here and there envelops and enshrouds revolving points of organization and life.

Whatever, therefore, we see around us in the world of organization has originally come from the atmosphere, and to the atmosphere it is hastening to return. What, then, is this reservoir from which so many wonderful things spring? The earth is about 8000 miles in diameter, the atmosphere is about fifty miles deep,—to the mass of the globe, therefore, as astronomers justly say, it bears about the same proportion that the down which covers the surface of a peach, bears to the peach itself. What! and is it this mere film that is the seat of organization and life? Is this the narrow boundary that comprizes the domain of living things? When I told you a while ago that already I alone had thrown into the air several tons of disorganized matter, the assertion seemed difficult enough to believe, but measured in the balance in which I am now weighing the world, what am I and you and all other living things? If, on this insignificant film, in the course of ages, we can make no appreciable impression, who shall put a proper estimate on all the power that we can exert, on all the most alluring objects of human life? Is there not an absolute nonentity of force, an absolute insignificance in all those projects which occupy the period of our existence? Are not the spaces of life long enough for all those trifling purposes? We dance like motes in the air, now in the sunbeam of pleasure and

now in the shades of affliction, and a little while suffices to sweep us and our works, and all our hopes and all our cares, into an absolute and irreversible oblivion!

> "The boast of heraldry, the pomp of power,
> And all that beauty, all that wealth ere gave,
> Await alike the inevitable hour:
> The paths of glory lead but—to the grave."

As we shall prove abundantly during the winter, the solid substances which are found in plants are derived from the Carbonic acid of the air, by the decomposing agency of the Sun. And it is on this material alone that the various tribes of animals subsist. We can therefore see that the vegetable world occupies a most important and intermediate position between the highest animals and inorganic matter. By the action of light the decomposition of Carbonic acid gas is effected, and from a gaseous substance trees and vegetables spring,—the various parts of which are absolutely essential to the support of animal life in the way of food. Plants, therefore, in the aggregate, may be regarded as solidified gases, which have been brought into that condition by the solar influence. They constitute, as the French chemists justly say, an enormous reducing machine in constant activity. How is it then with animals?

It is the office of animal life to discharge precisely the opposite duty to that of plants. The food which they take and which has thus been provided for them by the Sun, enters into their systems for a time, and becomes a transient part of their structure. But oxygen gas, constantly introduced by the lungs, effects the combustion of this solid material, changes its hydrogen into water, its Carbon into Carbonic acid, and it is thrown once more out into the air in the exact condition in which it was before the leaves of plants commenced their operation on it.

Thus, therefore, you see that if, in a chemical point of view, the vegetable world is a great machine of reduction, the animal world is correspondingly a machine of combustion; the one is antagonistic to the other; the one also is essential to the existence of the other. From the air plants constantly withdraw carbonaceous matter, to the air animals constantly restore the same. And now we have good reason to know, that for a thousand years the composition of the air has remained unaltered, whilst these incessant abstractions and additions have been taking place. And we perceive that these apparently unconnected chemical doctrines bring us at last to the extraordinary conclusion, that the amount of vegetable and animal life are by the Creator rigorously adjusted to one another; that plants do not take more from the air than animals restore, but that the action of the one is so adjusted to the action of the other that during the lapse of a thousand years the atmosphere remains untouched as respects its final constitution.

Let us carry our thoughts back to former epochs, and see what then took place. What is it that geology reveals, and which we all know to be true? In many parts of the globe, and in none more abundantly than the United States, enormous quantities of carbonaceous matter occur; deposits that cover hundreds of square miles in surface, and are of unknown depth, constituting the great fields of Anthracite and bitu-

minous coal. The aggregate of this in Europe, Asia, Africa, and in the great islands, cannot be estimated at less than many thousand millions of tons, yet, as is well known for no fact is better established in science, the whole of this is the remains of vegetable growth. The ways of Nature are unchangeable. Events as they happen now, happened also a thousand years ago. And just as the sunlight with us forms the solid materials of which vegetable structures are composed, so did it form the solid matter of which that coal is made. The Carbon which is thus stored up in the Earth existed formerly as Carbonic acid in the air, from which it was carried away by primeval plants and in the course of events buried in the ancient strata. The warmth therefore, which on a winter's evening we derive from the combustion of coal, and the light which is emitted by the flickering flame as it plays over the surface of the fire, originally came from the Sun, and were absorbed by the vegetable leaves, and now are restored once more by the process of combustion; and after its long imprisonment the Carbon escapes back again into the atmosphere from which it originally came.

The French chemists are therefore right in their assertion that though within the periods of history no change has happened to the constitution of the earth's atmosphere, if we go back sufficiently far, the reverse appears, and that the primeval atmosphere which once surrounded the Earth is now divided into three distinct and well marked regions,—the present air—the great coal deposits of all kinds—and the bodies of all vegetable and animal forms. That this tri-partition has been mainly brought about by the Sun, who whilst he has been occupied in directing the revolutions of his attendant planets, has also arranged and beautified the surface of the Earth, and prepared it for the reception of intellectual races.

What, then, are the final impressions we gather from these considerations? For as we advance in knowledge all our views of the nature and connexions of things change, and new and interesting relations spring up. Whoever among you for the first time hears of these results of modern science, must necessarily have his former ideas enlarged, and his understanding of the qualities and connexions of the most obvious things around him improved. In the midst of these changes, moreover, new thoughts must necessarily suggest themselves —thoughts which tend to the nature and laws of the government of the world. The great divisions of the animal and vegetable kingdoms come now before us, not as solitary and independent existences, but as things made for one another and acting upon one another. There are, besides, nobler and still more interesting reflections. It is a property of all the works of man, that they continue to produce their intended result for a time, and then they pass away,—the temple goes down in ruins, the ship is lost in the sea, and strains of music die away in the air. Of the words and the works of the great men who have raised themselves to the head of their race, what in a few years is the inevitable destiny? Is it not to come to an end? Of the twenty millions of people who inhabit this country, how many are there who have never heard of the battle of Pharsalia? how many are there who do not know what took place in the pass of Thermopylæ? It is, I say,

the property of all human works sooner or later to come to an end. But how is it in natural affairs? The facts of which we have been speaking serve to show that every thing is arranged as it were in a recurring series—a series which turns in upon itself; and from one point to another there is a perpetual tendency to restore all things to their original state. The substances of which vegetables are composed, and which they abstracted from the air, they yield as food to animals, who, when they have done with it, restore it to the air again: it runs, therefore, in an eternal cycle—the inorganic, the vegetable, the animal—the inorganic, the vegetable, the animal—and so it goes on for ever. It is the peculiarity of the works of God that they contain within themselves principles of self-conservation, the power of evolving from apparent ruin the principles of order. The affairs of men march forward in a straight line, and each moment removes them farther and farther from the original point: the affairs of nature return in circular paths, and after the lapse of a time are all brought back to the point of departure, and commence once more their perpetual motion. The stars in the sky are examples of these truths. They revolve in their elliptic orbits age after age, and punctually come back to the starting point. We see the moon waxes and wanes, and runs through her monthly race: the first man saw the same thing.

Whilst thus in human affairs the element of ruin is necessarily involved, in the affairs of nature the element of eternal duration is constantly bound up. Each class of events contains within itself the principles of its future recurrence, and the march of things is so regulated as to give birth to similar things hereafter. And may we not gather from these philosophical facts impressive lessons; and, comparing small things with great, discover from the phenomena of the government of the universe, the true principles for the government of man? Whatever is meant for duration must contain within itself the spontaneous principle of change—must include as it were in its very nature the law under which its mutations can be accomplished. These are the same results to which, by following another route, the progress of civilization has brought us. All constitutions which, like the laws of the Medes and the Persians, never change, must, like the laws of the Medes and Persians, under the necessities of nature, rapidly pass away. But forms of government which are to last for ever, must include within themselves the well marked laws by which they themselves can be changed; an apparent paradox, but yet a philosophical truth. What does the history of our race tell us? Whenever the attempt has been made to cause things to remain in a fixed position, the pent-up forces have gathered strength, and every barrier has been burst through by a final explosion; but wherever the ways of nature have been unwittingly followed, and the affairs and government of society have been allowed to change with the changes in the condition of society, stability, endurance has been the result.

In these circuitous channels, therefore, all natural events flow, and each isolated fact is the daughter of things which are older, and the mother of things that are younger. In the Universe no event has ever happened by and for itself alone; there were concurring and preceding events which gave it birth, and it joins with other contempo-

raneous events to determine the future. In the necklace of time there is a thread of destiny on which the beads are strung, which forces each to keep its proper position. Affairs come forward in their due rotation, they produce their predetermined effect, they are over; and whether it be in the revolutions which take place on the surface of the earth, or in the revolutions that take place in the celestial bodies above, the endless law of action is observed with inexorable precision. Those fortuitous events which occupy so large a space in the estimate of men, the free actions of the human race or the voluntary determination of animals, take place on too insignificant a scale to touch the far reaching result. We dance in a mazy path, perhaps often without reason or rule, but we are only microscopic forms that occupy an almost invisible space. Do the motes that dance in the sunbeam interfere with the onward sweep of the ray?

These considerations, moreover, serve to enlarge and purify our views. They point out to us the connexion which subsists between ourselves and the world in which we live, a connexion as it were of brotherhood with all animated things. Repudiating every misanthropic feeling, they point us to a common origin and a common destiny; they call on us to rejoice in the happiness of him who is successful, and to be merciful to him who is in distress. They bid us look on the surface of the globe, and remember that there is no spot upon it in which the ashes of those who have lived are not entombed. Is there a breath in the air, is there a wave in the sea, which has not flowed over the dead? In the quietness of the night and in the tumult of the day there is no moment in which myriads of living forms do not come to an end. And of the myriads even of our own race who have inhabited the earth, what is the record that remains? It is here and there that some gigantic mind or some energetic spirit, has refused to go back into the land of the forgotten, and has burst through the law of destiny,—physicians, philosophers, statesmen, and soldiers, appear among the ruins of the past. Give me the man who trembles to die. The name of Hippocrates, the father of us all, stands forth imperishable in pre-eminence. There is something more than an empty vanity in earthly immortality. To speak to posterity, and after the lapse of a thousand years to make the hearts of future men leap at the words you have uttered or the deeds you have done. That is not Death.

From the revolutions which thus happen to all things, this movement from state to state, this transmigration of bodies, we may gather a lesson which of all other lessons is most useful to young Physicians. As I have already said, the glowing expectations of youth are cramped into a narrower space by mature life, and end in disappointment with the experience of age. And indeed there are few who, even in the morning of life, escape the bitterness of this lot. Among those of you who at the close of this session are to go forth and enter on the race of life, how many are there whose fate is already written, and those promises that hope has held out are predestined not to be fulfilled. From the thoughts which have occurred to us this evening, we may gather that the affairs of life are never continuous, that there are seasons of prosperity as well as seasons of disaster,—that there is no

evil so great but that it will come to an end,—that in the inorganic, in the living, and in the moral world, there is a succession of change. Remember, it is in the darkest thundercloud that the most brilliant lightning sleeps. And, perhaps, away in the far West, and in some future year, some of you will remember the things I have been telling you to-night,—that grains of dust and drops of water pass from change to change and take on in succession many a different form. It may then recur to you in your hour of disappointment that you were once told, that the tear which has flowed even in the anguish of despair, must sooner or later re-appear in the rainbow—which is the emblem of hope.

It has always seemed to me one of the most enchanting results of chemical problems and chemical pursuits, that when you thus follow them out they uniformly bring you to things which relate to yourself at last. There is no department of human knowledge which has done so much for the human race, or to which the rapid advance of civilization is so much due, as to this particular science. You saw this evening where we commenced, you see to what we are led. It is that practicability that is in it, that near relation which it holds to us and our doings, which spreads over it such a charm. You can easily understand how it is that escaping from the underground recesses of the caves of alchemists, it now forms the right arm of power of some of the greatest nations. What is it that constitutes the wealth of England, that controls her coal, her iron, that manufactures her cotton? Why is it that this science is looked upon almost with veneration in France? You can understand how it is that some of the greatest monarchs now living amuse their leisure hours with these pursuits. But, dismissing these generalities, your estimate of its importance will be permanently fixed when you shall find how closely it stands in relation to your own pursuits. It is for this reason that I propose this winter to make these matters a formal portion of our study, and have prepared a book which contains the evidence of what I shall have to offer you on the Chemistry of Plants. So far as I know in no College in the United States are the modern discoveries in Animal Chemistry introduced,—the very things which relate to the physician. It seems to be the opinion of most teachers of Chemistry, that inasmuch as this particular department wants the alluring brilliancy of experiment, and addresses itself rather to the intellect than the eye, that students of medicine in general were indisposed to undergo the trouble of mastering its dry formulas. Last winter, as many of you know, I made a slight trial of the matter, —the seats that it was predicted would be empty, were fuller than before. The American student was neither more lazy, more ignorant, nor more slow to perceive the great fact, than have been the students in Germany! The time had come. And now I hope to see this University, as it is the first to introduce these capital improvements, keep the first in the emulous race with all its sister institutions. I want to see it the great factory of Chemical discoveries and Chemical doctrines in the western world. I want to see the doctrines of Chemistry canvassed, and experiments in Chemistry made, and above all, and as the right road to the thing, Chemical theses written. It is in this spirit that I enter on my work this winter; and if, as I hope, the same spirit may arise in

you, though it is little that the professor, it is much that the student can do. There is nothing which would yield to me more heartfelt gratification, than to see those to whom I had taught the rudiments of this science take their rank as original discoverers with those great European chemical physicians who are fast forming Organic Chemistry into the shape of a perfect science. And if the opinions which I have taught and the views I have published, should, by the discoveries of my own pupils, be found irreconcilable with advancing knowledge, I trust I should feel, as the greatest of modern historians has said on another topic, a little of that spirit which animated those English sailors who were confined prisoners in the hold of a French frigate during the battle in Algesiras bay, who, regardless of threats of instant death from the officers around, and of the imminent danger of being sent to the bottom by the friendly discharges, gave three cheers for every broadside as it was poured in, because they knew that it came from the hands of their comrades and friends.