

Introductory lecture to the course of chemistry / delivered by Professor Draper.

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Draper, John William, 1811-1882.
New York University. Medical Department.
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Publication/Creation

New-York : Hopkins & Jennings, Printers, 1841.

Persistent URL

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Draper (Geo. W.)

UNIVERSITY OF NEW-YORK,
MEDICAL DEPARTMENT.

INTRODUCTORY LECTURE

TO THE

COURSE OF CHEMISTRY,

DELIVERED

BY PROFESSOR DRAPER. ✓

SESSION MDCCCXLI—XLII.



box 3.

Second Edition.
LIBRARY.
24065
Washington, D.C.
NEW-YORK:

HOPKINS & JENNINGS, PRINTERS, 111 FULTON-STREET.

1841.

UNIVERSITY OF NEW YORK

MEDICAL DEPARTMENT

THE NEW YORK

COURSE OF LECTURES

BY J. J. J. J.

1850

11

New-York, November 4th, 1841.

PROFESSOR DRAPER,

Dear Sir :

At a meeting of the Medical Students of the University of New-York, held in the Anatomical Theatre on the third inst., We, the undersigned, were appointed a committee to solicit a copy of your address for publication.

You will, therefore, confer a great favour upon the body empowering us, as well as ourselves, in allowing us the privilege of bringing the same before the public.

Yours respectfully,

FRANCIS V. CLARK of Pennsylvania,
Chairman.

EBENEZER SWIFT of Rhode Island,
Secretary.

BENJAMIN W. BARLOW of New-York,	}	<i>Committee.</i>
JOSEPH OLMSTEAD of Connecticut,		
ALEXANDER H. COOK of Canada,		
BENJAMIN A. RIVES of Virginia,		
J. MADISON PORTER of Maryland,		
HENRY R. CANNON of New-Jersey,		
ASAHEL BRUNSON of Tennessee,		
JOSEPH A. HOLLAND of Georgia,		
STEPHEN B. CLARK of Ohio,		

New-York, November 4th, 1841.

TO MESSRS. CLARK, &c.:

Gentlemen :

I have to acknowledge the receipt of your letter asking for publication, in the name of the class of medicine, a copy of my address, introductory to the course on chemistry.

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 individual and personal prosperity of yourselves, and 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.

INTRODUCTORY LECTURE.

GENTLEMEN :

EXTERNAL nature presents itself to different men under different forms. The landscapes around us impress us with their beauties in different ways ; the rock, or the valley, the flowing of a river, or the shadows of clouds stealing over the corn-fields. The human heart is at one time awakened by the strains of music, or gladdened by the setting of the sun ; and those strains linger with us long after the harp which gave them has ceased to vibrate, and the glories of those skies are before us, though day may have gone down. These sensations have become a part of us, they weave themselves into our being, they cast a colouring over all we do, they give a turn to all we say. Affected thus by the things around us, we take pleasure in regarding them under different conditions, and express ourselves about them in different words. It is thus that artists present their works under various points of view ; the broad and bold features of the pictures of one, are cast into the dim background of another, and new objects are brought forth with prominence.

We measure the skill of the statuary, the painter, the poet, and the orator, by the power with which they thus group together the elements they bring before us, and cast their forms or ideas in strongly marked characters. The scenes that pass before their mental vision, affect each one differently, and from this arise the many modes they employ, to fix our attention or to command our applause.

Even in the detail of professional education these principles apply. In bringing before his audience the subject he is to discuss, each public teacher follows the course which his fancy dictates. The form he gives it, exhibits the constitution of his own mind. It is, therefore, a plan that deserves to be complied with, for such, at the commencement of his academical career, to set forth the leading points of the system he means to pursue. On these occasions, custom surrounds him with many who take a deep interest in his undertaking, and are the qualified judges of its expediency. We live in an age of intellectual gladiatorship, and each one of us, in his own sphere, passes through all the strifes of professional competition. The public teacher is singled out, and the eyes of a thousand are upon him. On the arena, in which he is sent to spend himself for the public good, the kind wishes of those who are spectators may be with him, but there also he has to encounter PUBLIC CRITICISM, which is worse than the Roman lion.

There are, Gentlemen, few things which can bring more gratification to a public teacher, than the marked attachment of his pupils. It is with no ordinary emotion, and, I may also add, with an honest pride, that I see around me faces that are familiar. The sound of my voice in these halls, will drop as an old friend on some of you ; and if, from your tranquil and happy homes in our own beautiful VIRGINIA, you have followed me to this city of excitement, I trust

that here we shall once more renew our friendships as they were of old, when we studied together under the blue shadows of the distant Alleghany mountains.

The science which it falls to my lot to lay before you, has claims to which I would ask your attention for a few minutes. Medical men, and students of medicine especially, are prone to suppose that the connection existing between Chemistry and their pursuits, is limited indeed. To give information about the compounding of drugs, to furnish an antidote for a poison, or the means of its detection, with a few preliminary notions needful to the country doctor, of the art of grinding in a mortar, or straining tinctures through a filter, appear to be the sum of its value. We are all in search of things that are of practical utility, and in hastening to produce results of importance, perhaps we are in a measure justified in passing over things that are only ornamental.

I trust, before we part this evening, we shall have come to a different conclusion, and shall set a better estimate on the value of this noble science.

Let us, then, examine what are the relations of Chemistry to Medicine, — what the character of the facts it furnishes the student, — what the influence it exerts upon his professional education. Let us try to ascertain its actual practical importance. All knowledge is of course good in itself. But with us time presses, the scenes of active life are just before us, in a few months we mingle with them; there is no opportunity to dwell on any thing, except what appertains to the matter in hand. But, what if we find that these studies are intimately connected with the object we pursue, and are deeply concerned in our future professional eminence; what if we find that they are interwoven with the very elements from which we ought to begin? Hereafter it will delight us, that we have not to bewail the opportunities of acquiring knowledge omitted; that we have not to sympathize in those sorrows, for the want of philosophy, in which the gude wife of Ladlemouth, celebrated of late by Frazer, had to indulge, who weighed a pound of butter to Davie Fisher, with a two pound pair of tongs, putting in one leg and letting the other hang out of the scale. In addressing ourselves, therefore, to this task, let us come forward with pleasant expectations and a good will. With students of medicine, whatever is done must be done voluntarily; and all the learning we procure, must be with cheerfulness. And yet some of us still look back with pleasure on those early times, when we first came to drink at the fountain of knowledge. The grim aspect of the village schoolmaster, who improved on the scripture maxim of fastening knowledge like a nail in a sure place, — he drove it in at the head, and clenched it with repeated strokes of his rattan or rod, at the other end.

If to men, occupied with the ordinary pursuits of life alone, a knowledge of the phenomena of nature is of constant value to us, whose special office it is to control those phenomena, and to subdue the forces of the world to our own use, nothing can be of more paramount importance. The agents that build up these bodily structures, set in action and keep in operation their functions, are constantly antagonized by the external forces of nature, and so long as an equilibrium can be maintained, life continues. It is not alone spontaneously, and from innate causes, that diseases supervene. Most of the calamities with which we have to deal, take their origin in conditions and circumstances that are extrinsic to ourselves. What king goes to war, without first sitting down

and counting the strength and advantages of the king that is to oppose him? In private life, who adventures on a doubtful undertaking, until he has fairly estimated the obstacles he has to overcome?

The modes of thought of a physician differ from those of other men. We are taught to regard the animal frame, as an intricate and finished machine. The very practice of our profession daily assures us, that all the forces of external nature exert a control over it. There is no change of temperature, no alteration of locality, no variation of circumstance, that does not leave upon it some characteristic and corresponding impression. Some deleterious change takes place in the atmosphere, and we see a pestilential cholera sweep over the earth. There are diseases due to the sea, diseases due to the air, diseases due to the soil. The night airs are the harbingers of desolation, the sun-rays are full of death. Turn where we will, the hand of every thing around us is against us. And shall we, then, neglect to know what is the name and the nature of these enemies, or how we may best encounter their reactions, or turn aside their power?

Of living things, how few are destroyed by internal causes! Yet, even with these, the forms of disease mainly arise in philosophical events, and hence demand our deepest attention. The functions of organic life, which make their appearance in early existence, before those of animal life, are also the last to continue. The man worn out by mere old age goes down to the grave with the loss of one sense after another. The eye-ball has lost its lustre, and artificial aids become unavailing; the ear becomes closed, he cannot distinguish the voices of his friends around him; the other senses become doubtful; and as they gradually decline, so also the powers of the mind pass away. The memory clings awhile fast to the early scenes of youth, long after it has ceased to take note of the transactions of yesterday. An undefined and dreamy recollection at last comes on. Imagination and fancy cease; the powers of reason are extinct. The white bearded patriarch of an hundred years, sits quietly in his arm-chair by the fire-side, resting his hands on the top of his staff. With him animal existence is over.

And thus it is, — the same overruling agent which first called us into existence; which gave us certain powers, but denied us many more; which has made us the creatures of a limited freedom, not even giving us entire control over our own persons, for the heart still beats, and the lungs oxidate, and all the functions of organic life go on independent of our will; this same power smooths the decline of existence, and we pass silently through a region of forgetfulness, before we enter on that LAND OF DEEPEST SHADE.

So soon as the final event is over, and the powers and action of the nervous system finished, all the constituent atoms of which the body is composed, hasten to satisfy the chemical affinities which have so long been soliciting them, and which have indeed brought the drama of life to its catastrophe. From a state of unstable equilibrium these atoms enter on a more permanent condition, and mainly give rise to three binary compounds, — water, ammonia, and carbonic acid. These, evolving themselves into the atmosphere, are there ready once more to be acted on by the roots and leaves of plants, and thus continue their perpetual cycle of inorganic and organic states.

Now each one of these changes is the result of a philosophical act; it is brought about by physical laws. And do you inquire what these have to do with the study of medicine, and doubt whether a knowledge of them will be of value to you? Look round upon this world, and you will find your answer. Its land, its water, and its atmosphere, its climates, its rocks, and valleys, are all accommodated and filled up with living things. The seasons that come round each year, and bring their warmths and their frosts, come with a reference to living things. How is it that the palm tree and the cocoa-nut do not grow in Lapland, or the reindeer frequent the verdant fields of the torrid zone? Why is there one region given to the corn-plant, another to the orange, and another to the fig? The white bear loves the leaden skies of the poles and his native iceberg, far better than the beautiful sun-sets of eternal Italy. The Bengal tiger never roams out of the jungles of India.

Thus, then, you see that each region of the surface of the earth has its proper tenant, and each tribe is kept within fixed boundaries; and these boundaries are not bars of brass, nor impassable ranges of rocks. If the walls be invisible, the prison-house is not the less secure. Nature, you see, on all sides takes advantage of these physical agents of which we speak, and has made HEAT her goaler. There are tribes that are in the sea, and tribes that are upon the shores; some live in the deserts of Africa, and some among the snows of Greenland. The hand of Nature marks off by physical agents the surface of the globe, and gives each division its proper tenants. And then, she wraps them in instincts that bind them in their destined localities; instincts that become a part of their being. Does the Condor ever forget the tops of the Andes, or the Albatross the dark heavings of the ocean?

To teach you some of these laws is my duty. And where the subject is so vast, and the powers of the teacher so small, you will not expect a fair or a complete view. I cannot tell you of the multiplied inter-workings of those laws, which bring the world into the condition we see. I cannot picture before you the wild scenery, the changes it has undergone. I cannot show you the springs of life, nor spread before you the machinery that brings it to a close. There is no rock that has not been the witness of the mortal agony of living things; there is no grain of dust that has not been alive. I have not that enchanter's wand that calls into existence birds, and fishes, and beasts. I have not those black-letter books which reveal the constitution of the material world. But then I can point you to Nature, and tell you how atom and atom conflict, and how one law springs out of another, though I cannot trace their commencement or their consequences, and you will see that they are beautiful, and believe that they are true.

This, I say, is the proper mode by which we should study medicine. I would have you regard yourselves in the light of engineers, your duty is to repair a broken machine. First of all, then, learn its construction; obtain clear and distinct views of the connection of its several parts, and the precise mode of action of each. By the indiscriminate use of medicaments, or by resorting to active processes, you may sometimes succeed in breaking up forms of disease, as a watch that has stopped may be made to go again by the rude jolting and shaking of an ignorant man. But to find out the cause of its derangement, to reinstate it fairly, and without damage to its former integrity, requires one who

knows its springs and wheels, their reciprocal action on each other, and the end they are to accomplish. Read in the histories of medicine, and is there for any disease a form of practice that has not been tried? Where is the plant, where is the mineral, that has not had its turn? Look through our works on the art of healing of the last three centuries, and mark their uncertainties, their contradictions, the entire diversities of opinion; are they not an imperishable record of the greatness of human credulity, and the littleness of human knowledge? Or survey the forms of practice which obtain in distant parts of this country, familiar to some of you and me. The doctor throws over his horse the long-accustomed saddle-bags, richly freighted with calomel, and rhubarb, and opium, — a heroic practitioner, — he goes forth to discharge his errand of mercy, and often prescribes intuitively, without the shallow form of asking questions. But then he lives in a region where bilious fever is the name of every febrile commotion, and where hereditary rules, long ago handed down from established authorities, have brought the practice of physic into a form adapted to the *feeblest* capacities, and given for all diseases one grand specific, “which will arouse the recuperative forces, and break up trains of morbid associations, and shake the gall-bladder” with a vengeance.

Dean Swift used to say that he had cured a nobleman of an inveterate cough, the paroxysms of which came on when an easterly wind blew, by nailing the weathercock that was opposite to his windows, so that it pointed permanently to the south. The sarcasm of that cynical churchman is at once a rebuke and an example to us. It may teach us how little reliance can be placed on written rules in the restoration of an intricate machine; and a little investigation will often satisfy us, that instead of blisters and bleeding, these nails in the weathercocks will answer much better.

Thus much for a value of the knowledge of physical agents. We men are placed as isolated specks in the universe. There is not a force in nature which does not affect us; our very existence hangs upon their balancings and co-operations. With agents with which thus, as physicians, we are called upon to contend, shall we not become familiar?

To carry out these views, I intend, in an early part of the course, to give you a general idea of the structure of the earth, the ocean, and the atmosphere; the various laws which regulate each, and the phenomena they exhibit. Before we can reason with clearness on natural events, it is needful that we free ourselves from many common errors and prejudices, which, imbibed in early life, pass with us as current truths. They vitiate all our opinions, and perpetually lead us to erroneous conclusions. I shall not hesitate to press into our service, facts drawn from other sciences, provided they are illustrative of the matter in hand. Under the guise of a course of lectures on Chemistry, I mean to teach you the application of physical science to medicine, — it matters not whether it be Hydraulics, Pneumatics, Astronomy, or any thing else. What they can furnish, that we will take.

The custom of schools of medicine requires that a full course on inorganic Chemistry should be passed through. With this we shall comply, omitting for awhile all that relates to poisons, and their action on the human system; this we shall go over more in detail, in the separate department of Toxicology. I shall endeavour to bring before you in the way of experiment, whatever is no-

vel in these departments, — the changes within the last few years, have been great indeed. The important subject of ORGANIC CHEMISTRY, so far as it can be taught by lectures, will be dwelt upon.

In the history of all sciences certain eras may be observed, an era during which facts are obtained, and an era during which they are classified. During the first, we hardly see how to collate one discovery with another, each seems to stand by itself, isolated and alone. But, by and by, the faint traces of connection begin to appear, and we commence marshalling them in a proper order. The bricks that are thrown down in the street, lie there in confusion; it takes thought, and time, and labour, to form them into an imposing edifice. In Organic Chemistry those links of connection are only now beginning to appear. There is hardly a book of science that comes across the Ocean, which does not bring with it new facts, the co-ordination of which with those that are known, remains to be made. Facts are pouring in upon us, and the formative process is beginning; a few years will give us a science, which will bring more revolutions into medicine, than that changeable science has even yet witnessed: but then, they are those revolutions that lead to truth, they teach us the interior structure and composition of our own bodies, and the laws upon which those physical functions, which form a part of the phenomena of life, are accomplished.

The theories of the germination of seeds, which can only be studied in connection with Organic Chemistry, will lead us by an easy transit to the study of the laws of the development of organized material. The phenomena furnished by the growth of plants, and the transformation of their parts, have their analogies in animal life; so far therefore as vegetable physiology is related to Chemistry, I shall bring it before you; and there are few parts of this course, which will furnish more instructive or entertaining results.

The structure of the eye, the ear, and other organs of sense, you will become familiar with in your anatomical studies. Their physical relations you will study here. What I shall have to say to you about LIGHT, apart from its general connection with Chemistry, will have reference mainly to the action of the eye, and the conditions of vision. Nor shall I think it too trivial a matter, to encroach a little on the domains of optics, and explain to you the mechanical action of transparent and opaque bodies, on this subtile fluid. Is there any reason why you should not know the precise mode of action of a pair of spectacles, just as much as that of a hernial truss? Why, there are thousands of persons, who die in the belief, that spectacles perform the miracle of giving sight to the blind, through some intrinsic, inherent quality of the glass they are made of.

In the same way, we shall study the more striking phenomena of undulations taking place in the air, inasmuch as these are the cause of sound, and are therefore necessary to be understood, before we can comprehend what is known of the functions of the ear, and the vocal organs.

There are two different ways in which a demonstrative course of lectures on Chemistry may be given, depending entirely on the form of apparatus used. Exceedingly impressive results may be obtained by the use of large and ponderous machinery; a light may be emitted bright enough to dazzle your eyes for a moment, and darken them for the rest of the day: a sound may be set up loud enough to drown your most energetic applauses: and smells may be served before you, strong enough and complex enough to puzzle the nose of the

acutest virtuoso among you. But what then, — is this Chemistry? Moreover, the use of large machinery involves an excessive waste of time, — the lecture hour is consumed by one or two experiments, and the young student leaves the room impressed with results which he never can imitate, and hardly can comprehend.

But, on the other hand, by using arrangements less in magnitude, the same striking phenomena may be produced; and from the facilities of working them, the course proceeds with rapidity, experiment crowds upon experiment, conviction is obtained in a hundred ways. The invaluable advantage is also gained, that you go home and repeat what you have seen here; the way in which you saw it done was simple; you try if you cannot do it yourselves. Remember, then, that I do not propose to astonish your senses, and stupify your understandings; but my object is to show you the simplest and most striking way of producing these philosophical facts. For this mode of teaching I take no credit; it is now adopted by most of the leading professors of Europe, who prefer to rely on their personal dexterity, rather than on the magnitude of their implements. Whilst no experiment of importance will be omitted, each will be produced in such a way that you can repeat it for yourselves.

A mere exhibition of experiments is what medical men do not want; their object is to understand the natural laws, so far as appertains to their own studies. And those teachers who do not observe this course, must in the nature of the thing be led away, and have no time to explain the great principles of their science. In this, they resemble the chanting of singers in churches, who in their exercises pass lightly over words of emphasis and moment, but bring out the whole force of their voices, and join in full chorus, on some contemptible conjunction, or insignificant adverb.

You have already perceived, in what I have been saying this evening, how deeply the subjects which are here to be taught, are involved in the philosophical study of medicine. The Chemistry that has been taught in the schools, has but little to do with our profession; but that which is now rising into existence, is deeply involved with physiology. But let us not therefore despise the day of small things. All sciences come from little beginnings. We must look round on natural causes, and see their bearings, and study their reactions, and the progress of knowledge, which is intrinsically slow, is rendered doubly so by the indisposition that men have to learn the truth. Those of you that know the history of our profession, know well, that it has been the first to foster the truth and encourage knowledge; as to the rest of men, there is a striking resemblance between them and the printed notes of a piece of music, some are long, and some are short, — some are connected together, and some are alone, — some stand there with empty heads, and some with double-leaded.

The changes that we see in living things, are the consequences of fixed and immutable laws. The acorn never produces a fir tree; nor by any art or device, does any living thing escape its final dissolution; there is, as it were, a stern necessity in the case; a law of mutation, which prescribes the origin, the progress, the end of every thing. The hardy form of the strong soldier, must change into the care-worn aspect of the broken veteran. Whilst, then, physical and chemical forces have their operation, do not misinterpret what I say, — there is something more than these. When I reflect on the powers

of the human understanding, I am lost in amazement. What is it that gives to the mechanism of the brain these marvellous qualities? I perceive, that on its tablets are registered all the events that have happened in my life; there, too, are the impressions of all that I have heard, and all that I have read. There, too, are engraven the shadowy forms of the innumerable words and names of things, in the different languages I know. There, too, are pictured the facts and events which compose the domain of history and the sciences. In those silent galleries are hung the portraits of the friends that are around me, and of the friends that are dead. I call up lineaments whose realities are gone to decay, and revisit again the scenes of boyhood. The intricate music of Italian singers still lingers there, which I listened to years ago; or the more simple melodies of a country life. The echo of those prayers is still heard, which an unskilful tongue first learnt at its mother's knee. And now the power of remembering things that are past, is only one of the many functions of the brain; is it not also the seat of all that passion dictates, the source of all that action performs? In it are the first seeds of all that we resolve; and by it are received all those impressions which afford us pleasure or give us pain. The higher powers are also there, and above all, it is the house of REASON. Shall I then fail to assert the presence of a controlling principle of intellectuality, the operations of which I feel, the existence of which I know?

Science in its progress scatters light upon every object: and surely it should afford us no common pleasure, apart from the positive benefit we may reap, to understand the various modes of operation which nature employs in determining the structure, the nourishment, the accidents, the death, of a whole creation around us. There is no plant and no insect which does not call for our attention, and from which we may not gain an instructive lesson. Is it of no interest to know by what structural arrangement, and by what great laws of nature, one animal is fitted for one mode of life, and another for another?—by what apparatus the inhabitant of the sea can live where we must die, and perishes where we can live? How is it, that from the deep sleep of winter, trees and plants awake at the coming of spring, and put forth their leaves and flowers, and then sink again into their annual slumber? Deprived by nature of moving powers, and of the means of sensation, they teach us how organic life is cherished under a variety of forms. If, beginning at the remotest ranks of creation, we pass step by step from the dead, the inanimate, to the living, the complicated, and see in each successive class, organ added to organ, and mechanism to mechanism, and carefully mark the changes produced by each addition, of all lessons we shall find it the most instructive, for it teaches us that knowledge that men have been in pursuit of from the beginning, to know the world and to know ourselves. Have not the stars, which our fathers thought to be instinct with spirit, and perhaps to be living things, yielded their secrets to us? Do we not assign their places, their condition, and the laws that guide them in their paths? The comet, — that hermit of the universe, — that goes into the abyss, a pilgrimage of ages, when mortal eye cannot follow him, does not the hand of our intellect stretch itself forth, and, pointing his place in the immensity, do we not say, There he is? Our native earth, too, is gradually revealing her ancient history to us, not written in books which may be lost, nor conveyed in traditions which might be perverted; but, inscribed on the rocks and stamped

upon oceans. Do we not see faintly into her physical condition, at that remote epoch, when she was without form and void, and darkness was upon the face of the deep, and there was no living thing upon her? To attain all this knowledge, have not men of the first intellect, from the earliest ages, and in all the vicissitudes of life, with toil and with labour pursued their researches, and left the accumulation as a legacy for you to accept and to increase?

It is the admitted province of the physician to relieve those that suffer, and put aside the approaches of death. From these things arises the intrinsic nobleness of his profession. We judge of the power of any force, by the magnitude of the results it produces, and we may well judge of the character and quality of the forces he has to contend with, by the phenomena we see. A little while ago, I said, there was not a grain of dust that had not been alive. This indeed is no metaphor. Well might Cuvier say, "I look upon this world as a great charnel house." From the opal, that throws its ever changing rainbow-tints, to the JURA and ALPINE ranges — mountains that form the boundaries of empires, and have been landmarks in all time — these are all made up of the *exuviae*, the remains of things that have had life; either the bones of great animals, or shells, or fossil animalcules. In each single grain of tripoli, which is found in beds and strata many feet thick, and extending over areas of many miles, it is known that there are the remains of more than a hundred and eighty millions of individuals. What then is their aggregate? You cannot take up a little fragment of common chalk, in which thousands upon thousands of these beings are not found; and yet this chalk not only bounds the coasts of England, but stretches away across France, and reappears in Poland — POLAND! the country to which God must at last give freedom. It is found in central Africa, and once formed the cliffs of that ancient sea whose bed is now marked by the sands of the great desert of Sahara; it extends through the countries of Abyssinia, and, reappearing in Arabia, is lost in the unknown and barbarous kingdoms of Asia. But why should I carry you thus over the world, to witness the effects of exterior agents in the destruction of life? There is not a spot on which you place your feet, that does not cover the remains of unspeakable millions. Strata, thousands of feet thick, are made up of the bones of the great ones, cemented as it were together by the *exuviae* of those that are microscopic. And yet, all these once saw the morning sun come forth with gladness. Nor is it individual life that has alone suffered. Whole species, and tribes, and genera, have disappeared. With hundreds of others, the mastadon has gone, the ichthyosaurus, and the gigantic lizard, iguanodon. The very air which you breathe, the emblem of purity, comes from the respiration and putrefaction of beings that have lived before you, and are dead. The coal fields that furnish you with fuel, are the remains of primeval forests, among the branches of which, birds nestled at night. The very carcasses of the dead have changed the figure and form of the face of the earth; they have raised the bed of the seas, and thrown the waters on dry land; and, with those changes, have come changes in the tribes that inhabit it. There has been an age of fishes, and an age of reptiles, as well as an age of quadrupeds, and an age of man. To look back upon those former epochs, through which this globe has passed — the preparatory stages for the reception of human organization — to see the first dawns of life in the midst of darkness and solitude, there is a

solemnity which overhangs those distant ages, before which the "trifling pendaries of historical antiquity die away." They do, indeed, as an able author tells us,* bring us in contact with the dark, the awful, the overwhelming. We see the successive rise and disappearance of endless races of animated things. Are not the solid continents made up of the remains of organized beings, that have filled up their periods of happiness and passed through the dread portals of death?

"The dust we tread upon was once alive!"—*Byron*.

In passing thus in imagination through those distant epochs, we feel indeed that we are roaming through the empire of ancient Night and Demogorgon; that we visit a world unlike our own. The wildness of those landscapes, the lurid darkness of those skies, is in keeping with the inhabitants. The broad arms of the coal trees wave lazily in the night air, that bears with it the cry of fighting lizard dragons, and the shrill hiss of the dying iguanodon.

There is a moral lesson which we, as physicians, may gather from these natural histories. We see that not only have individuals passed away, but also whole species, tribes, and genera, have become extinct. In the periods of human record has not the same thing happened? Great empires and mighty republics have ceased to exist, and the specific tribes of men that founded them have vanished. Now all this comes to pass through the operation of general laws. Over these, as physicians, you have no control; your errand is to the individual, not to the race. It is yours to perform the lesser duty. You never change the march of events that reach over centuries. Their destinies are governed, not by the physical laws I have spoken of, but by a separate code of laws that belongs to the moral world; the physical are only the executioners of a moral verdict. The march of events in the human family, is as little under your control as the march of those planets in the sky. In the operations of nature but little account is made of individuals; their days of fortune seem to come of themselves, and days of distress and disaster are not to be avoided. The joys and calamities of life rise up, as it were, spontaneously before us. The consolation of the unfortunate is, that he was not the author of his own wo. And these things lie at the bottom of our hope, that the differences of individual happiness in this life do require to be balanced in an hereafter. But in the affairs of society we behold a strong contrast; there is no appearance of that transient duration, that suddenness of action, which occurs in the individual. All things are slowly evolved; they reach their maturity; they decline. The broad hand of an overruling PROVIDENCE is also plainly discovered, dispensing with an unerring justice the rewards of national merit and national crime. Is not the Spaniard still in the hands of an avenger, for the Indian blood that cries for retribution from the silver mines of Mexico? For the failings of the individual there is mercy; but in the ways of eternal justice no mediator is provided for the crimes of society: there is an instant, an inflexible recompense of good for good, and evil for evil.

You see, then, what is your province; what the nature of the forces you have to encounter; what the results they have brought about. You can only

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overcome them by understanding them. And these are the paths along which we have to pass. Though I have detained you long in coming thus far, it is in the hope that these preliminary reflections may find an use. I *knew* that I could seduce you into the ways of physical knowledge, and hoped that the hour we were to spend together, might bring you to a proper estimation of chemistry.

FINIS.

