Dunglison (R.)

AN

INTRODUCTORY LECTURE,

DELIVERED TO THE CLASS OF

INSTITUTES OF MEDICINE,

IN

JEFFERSON MEDICAL COLLEGE,

OCTOBER 19th, 1848.

BY

ROBLEY DUNGLISON, M.D.

Box 3

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CORRESPONDENCE.

JEFFERSON MEDICAL COLLEGE, November 5th, 1848.

PROFESSOR DUNGLISON,

Dear Sir,—The Members of your Class being desirous of procuring your Introductory, delivered on the 19th of October, have appointed the undersigned a Committee of that body to respectfully solicit a copy of the same for publication.

Very truly yours,

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Committee.

PHILADELPHIA, 109 SOUTH TENTH STREET, Nov. 21st, 1848.

Gentlemen,—For reasons which I assigned, in person, to a portion of the Committee, I have delayed, thus far, replying definitively to your letter of the 5th inst., asking for a copy for publication of my Introductory Lecture delivered on the 19th ultimo.

As the committee have been so courteous as to reiterate the request, I cheerfully furnish them a copy for publication; begging them to express to the class my high sense of the compliment they have paid me, and to believe me, with great regard,

Their faithful friend and servant,

ROBLEY DUNGLISON.

To Messrs. J. W. DREWRY, President,
L. BRANDT, Secretary,
J. L. ADKINS,
A. HARDCASTLE,
P. S. CROOM, &c. &c.
Committee.

INTRODUCTORY LECTURE.

Gentlemen of the Class of Institutes of Medicine:—

Although habituated, for a long series of years, to meet a class of medical students, such an occasion as this never fails to produce in me mixed emotions. Nor do I envy the teacher who can enter unmoved upon such arduous and responsible duties as devolve upon me here. Did not the generous greetings of young, warm-hearted disciples agitate him—whilst they at the same time encourage him to put forth all his efforts in their behalf, that he may enable them to fulfil the elevated purposes for which they left the paternal roof,—

> "The social circle of their friends,
> The lov'd community in which they're link'd,
> And in whose welfare all their wishes centre,"

his sense of the onerous nature of his varied functions could not fail to do so. Who, indeed, could see congregated before him representatives from every part of this almost illimitable country, and even from distant lands, listening daily to his lessons, and placing their hopes of success in life in a great degree on the instruction which he may impart to them, without feeling an overwhelming responsibility, and an incentive to exertion, which may be equalled in other avocations but cannot be surpassed. Deeply impressed with those sentiments, I enter upon my allotted office with a firm determination, that every effort shall be devoted to your service; and as cordially as my colleagues, who have preceded me, I bid you welcome to these halls.

It has not been customary on occasions like the present for the Professor to confine himself to matters strictly introductory to the department which it falls to his lot to teach. Usage appears to have permitted him to digress. Not a subject that forms any part of medical science has escaped attention, and it has occasionally happened that he has left altogether the

domain of medicine, and wandered and revelled in other departments of science. A course of Institutes of Medicine has had for its usher and prolegomenon an essay on hunting,—a subject which might, however, afford an opportunity for introducing important and interesting hygienic considerations; and it has fallen to my lot to sit and listen to a learned but somewhat imaginative discourse from a veteran professor—my colleague in another institution—now no more, on the natural history of the "Seventeen Year Locust"—*Cicada septendecim*, as introductory to a course of lectures on the Theory and Practice of Medicine.

Often, on such occasions as the present, I have chosen a theme to illustrate some great medical truth or lesson, which might not flow immediately from the topics that are usually discussed in Lectures on the Institutes of Medicine; yet still connected with the great doctrine of life, Biology—to employ a term in a general signification, which modern custom has restricted to physiology alone.

In its general signification how comprehensive is this term: Biology—"the doctrine of life;"—of life in its essence, of which we know nothing;—of life in its manifestations, of which we know much. Not restricted to animals, to

> ——"Man,
> Beast, bird, fish, insect, what no eye can see,
> No glass can reach,"

but embracing the phenomena that are presented by the vegetable kingdom, from the towering monarch of the forest to the humblest lichen that incrusts the rock. Striking as may be the sensible differences presented by the beings of the animal and the vegetable kingdoms, modern researches have shown, that in their morphology or anatomy, in their physiology or functions, and in their modes of growth and reparation of injuries, there are marked analogies which have been too often overlooked by the inquirer, or have not received the consideration that they merit. To some of these it is my wish to ask attention this evening, and to indicate briefly the direction which recent investigations have taken on this subject.

Throughout almost all time, philosophers have agreed in dividing the occupants of the domain of nature into two classes of bodies,—the *inorganic* and the *organized;* in other words, into those that are not provided with organs or instruments for the execution of certain functions, and those that are.

In the first class are placed all mineral substances; in the second, animal and vegetable bodies.

It could not fail to be observed, that, in the organized, an impulse exists, which gives occasion to the formation of such organs or instruments according to a definite plan, gradually developing the plant from the seed, as it does the animal from the ovum or egg, so unerringly, that no confusion results; and enabling the shape, size, and duration of the oak to be as assuredly pronounced from the inspection of the seed, as those of the bird from its egg.

An instinct or impulse—a Trieb, as the Germans term it—a vital force must be present, which presides over, as it were, and directs the movements of the living body in the development of tissue after tissue, and organ after organ, and whose action terminates not, until every trace of movement is impracticable; and the being—animal or vegetable, as the case may be—ceases to be a thing of life. For a long period the physiologist was satisfied with noting the analogy between the different functions of the two divisions of organized bodies, and the marked differences that exist in their morphology; but in modern times he has been emboldened to extend his researches farther. The intimate investigation of the tissues, both animal and vegetable, has been ably and industriously undertaken, and with the aid of the microscope and organic chemistry, so much light has been thrown upon minute anatomy, that an almost new branch, histology, has been added to the science.

It early suggested itself to histologists to inquire, whether all organized bodies, resembling each other as they do so highly in their mode of development, might not, by ultimate analysis, be found to originate in the same manner; but it was not until about twenty-five years ago, that the Edwardses of Paris ha-

zarded the novel assertion—a result of their microscopic observations—that all animal and vegetable structures are constituted of globules exactly alike, and about one eight thousandth part of an inch in diameter; in other words, that all organized bodies possess the same elementary or ultimate structure.

Although farther microscopic researches did not establish the views of the Edwardses, an impulse was undoubtedly given by them to farther investigations into the simplest expression of organic life; and it was soon boldly affirmed by Raspail of Paris—whose wayward and enthusiastic disposition has led him to sacrifice the sober pursuits of science for the vexations and turmoil of politics—that the ultimate structure of all organized textures is vesicular, and that the organic molecule, in its simplest form, is an imperforate vesicle, endowed with the faculty of inspiring gaseous and liquid substances, and of expiring such of their elements as it cannot assimilate,—properties, which he conceived it to possess under the influence of vitality; but of the nature of such vitality he judiciously acknowledged his utter ignorance, comparing it to the unknown quantity x in an algebraic equation.

The views of Raspail, although in many respects visionary, were clearly the foreshadowings of those announced by Schwann and Schleiden, the authors of the now world-renowned cell doctrine of histogeny, or of the belief that the new-forming tissues of vegetables and those of animals originate—the former from a liquid gum or vegetable mucus; the latter from the essentially fibrinous portion of the blood—the liquor sanguinis; in which granules or nuclei exist, from which primordial cells are formed, and that from a special arrangement of those cells the various tissues of organized beings are regularly and consistently developed. To employ the language of Schwann, "the elementary parts of all tissues are formed of cells in an analogous, though very diversified manner, so that it may be asserted, *that there is one universal principle of development for the elementary parts of organisms however different, and that this principle is the formation of cells.* A structureless substance —as the liquid gum of the vegetable, and the liquor sanguinis of

the animal—is present in the first instance, which lies either around, or in the interior of cells already existing; and cells are formed in it, in accordance with certain laws; which cells become developed in various ways, into the elementary parts of organisms."

It thus appears, in the existing state of knowledge, that when we reduce a living tissue to its simplest histological expression —whether that tissue be animal or vegetable—it is under the form of a nucleus or granule or cell-germ capable of being formed into a cell, which cell is possessed of special formative appetencies, according to the particular tissue that has to be developed from it.

When this simple fact, astounding in its simplicity, was announced, it was believed by shallow reasoners, that we had attained, or were about to attain, a knowledge of the nature of even life itself. It is obvious, however, that we have approached no nearer to an acquaintance with that mysterious essence or impulse which gives occasion to one cell pursuing a different, but, in all cases, analogous development; and in the case of man, from the moment of the mingling of materials derived from both parents at a fecundating union, impels not only to the formation of a new being resembling those from which it was derived, but one possessed of hereditary, often morbid tendencies, some of which may not be called into action until after many years of independent existence. Yet that such tendencies must be present in the structureless substance furnished as the result of sexual union cannot admit of question.

But not only have recent researches exhibited an identity in many of the morphological relations of organized bodies, they have likewise shown an identity in the chemical relations of those bodies, which was previously unsuspected. It is not many years since it was laid down as an essential difference between an animal and a vegetable tissue, that the former consists of four elements or is quaternary in its composition, having for those elements oxygen, hydrogen, carbon and nitrogen; whilst vegetable tissue is ternary or composed of but

three elements — oxygen, hydrogen and carbon. It was known, indeed, that the fat, for example, of animals, has only the three elements, thus resembling starch in its composition; but still the main difference between animal and vegetable substances, chemically considered, was believed to be, that the former contain nitrogen or azote, whilst the latter do not.

It is now known, that the organized portions of all vegetables and of all animals are constituted, chemically, essentially alike; and farther—to adopt the language of Liebig—"the most recent and exact researches have established as a universal fact, to which nothing yet known is opposed, that the nitrogenized constituents of vegetable food have a composition identical with that of the constituents of the blood;" and that "no nitrogenized compound, the composition of which differs from that of fibrine, albumen and casein, is capable of supporting the vital processes in animals." Whether these last positions, and, indeed, the general view entertained by Liebig on the subject of nitrogenized and non-nitrogenized aliments be correct, will be a topic of inquiry with us; but that the constituents of the organized tissues of animals and vegetables are alike is admitted by all; and the value of such a knowledge to the pathologist and practitioner may be elucidated by a single example.

When a tendency has existed to an undue deposition of fat, so as to constitute adiposis or obesity, it has been generally advised, that the patient should be mainly restricted to vegetable food. A knowledge, however, of the chemical constitution of vegetable substances indicates to us, that whilst to the organized portions of vegetables there must be as little objection as to those of animals—and, therefore, the green vegetable may be permitted as food—well-founded objection may apply to the amylaceous and saccharine, which, being like fat ternary, will, it is presumable, be more readily converted into fat than the organized portions of animals, as flesh, or those of vegetables, which are quaternary, and, in order to be converted into fat, must part with the nitrogen that enters into their composition. In like manner, in diabetes, which consists in a secretion of saccharine urine, formed, in part, at the expense of the

system, if it be desirable to restrict the patient to nitrogenized diet, from which sugar can scarcely be so readily formed as from the non-nitrogenized, the green vegetable need not be prohibited, as nitrogen enters into its composition, whilst starch, which is readily converted into sugar in the digestive process, may be esteemed altogether inadmissible.

I have spoken, gentlemen, of an impulse seated in the living ovum and seed, which, under favourable circumstances, leads to the development of an organized body, according to a definite plan and arrangement; and which, in the case of the vegetable always, and of the animal at an early period, gives occasion to such development under circumstances that are worthy of consideration, and that lead us to inferences very different from those usually entertained in regard to the increase and growth of the fully developed animal. The germ of the chick, for example, is surrounded in the egg by the nourishment necessary for its development; but, so far as can be seen by the most powerful microscope, that germ possesses no nerves, no blood, both of which have been regarded by many as indispensable to the growth of parts in the fully formed animal. Yet gradually, under a special arrangement of cells, tissue after tissue becomes developed, organ after organ is evolved in succession, until the full period of incubation is accomplished, when the young animal breaks the shell to assume an independent existence; perfect in an organization moulded and fashioned under its own life-power. Cells exist, at first, without the slightest appearance of blood-vessels; gradually, however, minute dots become perceptible, which coalesce; and blood is seen before continuous vessels are prepared to receive it; vessels exist before the heart; vascular tubes are formed, and become filled with blood: at first these tubal fragments are seen to be distinctly separated from each other; but subsequently they become united; and when a powerful central and muscular organ, the heart, is superadded to them, the apparatus of the circulation is complete, and fitted for its great objects.

So is it in regard to the neurine or nervous matter, which,

in the aggregate, forms the nervous system. Evolved in distinct portions—in detail, as it were—it is not adapted for that wonderfully perfect system of association—for that bond, which unites the various parts of a complicated and dependent machine—until the separate portions have united, and the various ramifications have become connected with central ganglions, to which, in the higher organisms, impressions received by the sentient extremities of the nerves have to be conveyed.

We thus comprehend that *life-power* and *nerve-power* are by no means identical; that the former exists before nerves are developed; and, in the vegetable kingdom throughout,—not in the humblest moss only, but in the fairest flowers of the parterre and the gigantic occupants of the forest,—we may vainly look for aught resembling the nervous system of man and the higher animals. It is true the pith of the vegetable has been likened to the neurine of the animal; and a ganglionic nervous system has been ascribed to the former; but how forced must be the analogy between the morphology of vegetable pith and that of animal neurine, and how defective the evidence in favour of their functional identity or resemblance!

If this, then, be conceded, we must equally admit, that all the functions which are exercised by vegetable bodies are carried on without nervous agency. Nutriment must be received from without; the fluid which passes from cell to cell, or in vessels formed by the aggregation of such cells, and which is the pabulum for all nutritive action, must be in constant progression, and be conveyed to the surface of the leaves, in order that it may receive from the air the same kind of indispensable influence that is impressed upon the blood in the lungs; from this fluid must be formed every secretion, bland or acrid, fragrant or repulsive, of which the vegetable kingdom presents so vast a variety: every product of nutrition, from the coarsest vegetable fibre to the most delicate and exquisitely formed petal;—all can be, and are, evolved under the influence of that pervading life-power, as perfect in their kind as in the most perfect animal. To the vegetable, in other words, as to the

animal, belong the functions of digestion, absorption, circulation, respiration, secretion and nutrition; and hence these functions have been termed *organic*, because they belong to all organized bodies; *vegetative*, because they are independent of animality; and *nutritive*, because they are inservient to the nutrition of all living bodies.

In the lowest confines of the animal creation, where, as in the monad or in the simple primordial cell, we may vainly look, with the aid of the most powerful microscope, fashioned by the most skilful of modern mechanicians, for the presence of nervous centres or even of rudimental nerves, all these functions are accomplished in the same manner as in the vegetable; and it is only as we ascend in the scale, and discover, in the series, a more and more complicated nervous apparatus, that the problem becomes more involved. The nervous system, however, we shall find, is destined for the most elevated *rôle;* and whilst its functions are most mysterious and all-pervading, so as to modify materially, by association, the nutritive actions; still, the conclusion is irresistible, that those actions are not conducted under its presidency, but are the result of that *vis insita* or instinctive force to which I have so often referred.

Another important result of observation, to the pathological and therapeutical inquirer, is the fact of the similarity—if not identity—in the actions of the instinctive force in animals and vegetables, when a reparatory power is needed by them. If an injury be inflicted upon a tree; if a branch, for example, be forcibly separated from it—provided the injury communicated to the parent stem be not more extensive than the recuperative powers are capable of rectifying—a process of reproduction is established; cell after cell is developed, until ultimately the lacerated and exposed surface is wholly healed, and in a manner strikingly corresponding to what is observed in the animal under similar circumstances. In many vegetable species, this recuperative process is exhibited in the speedy reproduction of lost parts; as in the grass of our meadows, and in several of our garden vegetables, as spinach, parsley, cress, &c.;—their great

utility to the horticulturist being dependent upon the circumstance, that new shoots quickly supply the place of the stalks and leaves that have been removed. In the animal kingdom, we have analogous examples. The lobster can reproduce its claw; the water-newt its lost extremity, or eye; the serpent its tail; and the snail its head. In like manner, the teeth of the rodentia or "gnawers"—as the squirrel—when broken, are reproduced; and in all animals, the tegumentary appendages—as the hair and nails—are regenerated, as the stalks and leaves are in the spinach. In all, too, as in the vegetable, there is a sanative power, which is capable of repairing their wounds and injuries, when those injuries are only within certain limits. We witness it daily in slight lesions, which receive little or no attention; and in more serious injuries, where there is a loss of parts, and to which only the simple dressings of the surgeon are applied. It is still more strikingly exemplified in cases of simple fractures of bones, where no application *can* be made to the broken surfaces, and where the surgeon confines himself to maintaining the parts in apposition, and in strict quietude—trusting to that instinctive force which is present, and knowing that under its monitions a blastema or matrix will be thrown out of the vessels of nutrition, containing exudation corpuscles or germs, which possess within themselves a cell-forming power, and are gradually developed into a firm bond of union. The vulgar are impressed with the notion, that there are healing salves; but the well-instructed surgeon knows that no such compounds exist. He may, indeed, apply unguents, that have ordinarily had the epithet "healing" affixed to them; but it is only for the purpose of keeping the parts softened, and for preventing the access of air—the desiccative and other influences of which may act injuriously—whilst all his expectations of reparation are reposed in the sanatory instinctive force, whose operations are manifestly directed towards the preservation and reparation of the frame, and of every part of it.

The overwhelming influence of this "instinct"—as it has been well termed by Virey, Fleming, Good, and others—is thus ably described by the last-named physician and philosopher. "In

every organized system, whether animal or vegetable, and in every part of such system, whether solid or fluid, we trace an evident proof of that controlling and identifying power, which physiologists have denominated, and with much propriety, 'the principle of life.' Of its cause and nature we know no more than we do of the cause and nature of gravitation or magnetism. It is neither essential mind nor essential matter; it is neither passion, nor sensation; but though unquestionably distinct from all these is capable of combining with any of them; it is possessed of its own book of laws, to which, under the same circumstances, it adheres without the smallest deviation; and its sole and uniform aim, whether acting generally or locally, is that of health, preservation or reproduction. The agency by which it operates is that which we denominate or should denominate '*instinct*,' and the actions by which its sole and uniform aim is accomplished are what we mean or should mean by instinctive actions; or, to speak somewhat more precisely, instinct is the operation of the living principle, whenever manifestly directing its operations to the health, preservation or reproduction of a living frame, or any part of such frame. The law of instinct, then, is the law of the living principle; instinctive actions are the actions of the living principle, and either is that power which characteristically distinguishes organized from unorganized matter; and pervades and regulates the former, uniformly operating by definite means in definite circumstances to the general welfare of the individual system or of its separate organs; advancing them to perfection, preserving them in it, or laying a foundation for their reproduction, as the nature of the case may require. It applies equally to plants and to animals, and to every part of the plant as well as to every part of the animal, so long as such part continues alive. It is this which maintains from age to age, with so much nicety and precision, the distinctive characters of different kinds and species; which carries off the waste, or worn out matter; supplies it with new, and in a thousand instances suggests the mode of cure, or even effects the cure itself, in cases of injury or disease. It is the 'divinity that stirs within us' of Stahl; the *vis medicatrix naturæ* of Hoffmann and Cullen, and the physicians of our day."

How important—essential—then is it for the physician, and especially the young physician, whose energy in the application of remedial agencies is generally in an exact ratio with his want of experience, to bear constantly in mind, that such a "divinity" —*vis medicatrix naturæ*, if you so term it—is ever present, and that its monitions are not to pass unheeded. The very name *physician* indicates etymologically "an observer of nature;" and *physiology* "the doctrine of nature;" and no physician is worthy the appellation, who has not carefully studied the natural or instinctive actions—the phenomena of life—in every phase of health and disease; and is above all things careful, that his appliances are made so as not to disturb those actions when they are manifestly or even obscurely directed to the establishment of health in injuries or disease:—

> "For nature then has room to work her way;
> And doing nothing often has prevailed,
> When ten physicians have prescribed and failed."

In the time of Stahl, upwards of one hundred and fifty years ago, when what was called the *Medicina expectans* or "Expectant Medicine,"—which consisted essentially as the name imports in "waiting" until the disease, in favourable cases, got well spontaneously,—was the fashionable doctrine; and for ages in Continental Europe, when the most inert practice prevailed, disease was found to yield in such a degree as to lead the practitioners of the period to ascribe to their feeble efforts an influence on the morbid condition, which it would be absurd in us to accord them; as absurd as it would be to admit, that the hypothetical views and agencies of a sect—if it may be so termed—of practisers of the healing art, now teaching their delusive doctrine in this very city, could be based in truth. In view, indeed, of all the evidence brought forward by themselves of successful practice—for they boast of success from the exhibition of their infinitesimal doses—can we conceive, for a moment, that a single symptom yields to the action of the drug, or of the odour of the drug, which is employed by them to combat it? And are we not justified in concluding with a

distinguished London friend and physician,* much misunderstood, much misrepresented, and maligned, but who, on his recent retirement from the editorial chair of one of the best-conducted medical reviews in any language, received a solid and enduring testimonial of the estimation in which he is held not only in his own country, but in both hemispheres:—are we not justified in concluding, I say,—that there is a power which, whilst it explains all the triumphs of homœopathy, reduces those of regular practice within much narrower limits than its more zealous votaries are wont to assign it: "this is the power of nature" directed by the Deity, by that Almighty Being, who —to employ the language of a pious poet and philosopher—

> "Lives through all life, extends through all extent;
> Spreads undivided; operates unspent."

It is for the physiologist, then, to endeavour to penetrate—through not only the tribes of animated nature, but all living creation—the natural or instinctive actions that produce the wondrous results to which I have only been able to allude in this discourse, and which will form the subject of so much pleasing investigation in the course opening to us. From what I have even now said you will have understood that the human body appears to consist of a series of cells constantly in action, whose function it is to produce, each after its kind, organized tissue; such cell doubtless differing in each tissue in its morphology and endowments, as much as many of the lowest orders of animals differ from each other; deriving its nutriment from the blood; having a determinate existence, and capable of reproduction, decay and death; so that molecular death and reproduction may be said to be constantly succeeding each other in the tissues, after the same fashion as they might follow were the cells so many monads placed out of the body; and all this occurring according to laws not the less existing, because, in our limited and misty comprehension, we are incapable of appreciating them. Nor does this apply to the healthy condition only. In the organic changes which take place in a diseased tissue—so far as our microscopic and other researches carry us—we find the pathological conditions of cell-life equally supervening in a

* Dr. Forbes.

definite manner; and, doubtless, did our restricted powers of observation enable us to pierce the nebulosity, we should be convinced that laws, fixed and immmutable, preside over abnormal, as they do over normal development. In man and the upper classes of animals, except in the morbid condition—and rarely then—do we notice that rapid propagation of cells which is seen in the lower animals and in particular beings of the vegetable kingdom. The rapid development of the embryo strikes the physiologist with astonishment; but this is trifling, compared with the growth of certain morbid formations occasionally witnessed; and almost infinitesimal, when we turn to the development of insects and cryptogamous plants.

The larvæ of the flesh-fly, produced from eggs deposited in carrion, are said to increase in weight two hundred times in the course of twenty-four hours; and the quantity of nutriment they consume in consequence is so enormous, that Linnæus hazarded the assumption, that three of these, and their immediate progeny, each female giving birth to at least 20,000, and a few days sufficing for the production of a third generation, could devour a dead horse with greater quickness than could a lion.

But even this is not equal to the rapidity of growth of the *Bovista giganteum*, a large fungus of the puff-ball tribe, which has been known to increase, in one night, from the size of a mere point to that of an immense gourd estimated to contain 47,000,000,000 of cellules,—as if one million of these cellules were formed every second. In view of such velocity of production, can we be astonished—knowing, as we do, that the air teems with animal and vegetable existences—that the pathologist should have had recourse to the hypothesis of insect or cryptogamic life to account for the production of certain epidemic diseases, which, like malignant cholera, it is impossible to assign to any ordinary and well-known causes; and the very diffusion of which over such an extent of the earth's surface, would seem to imply that the poison—whatever may be its nature—is capable of rapid and extensive reproduction; and what inorganic substance is there—in the existing state of our knowledge—which is susceptible of this? The animalcular

nature of the cholera poison has been maintained by many upon hypothetical grounds, and it must be admitted, that impressive facts and cogent arguments have been advanced in its favour; but there are those who consider, that the fungous origin is more probable, based on stronger arguments, and on more scientific foundations than the animalcular. Nor does the transportation of either animalcules or cryptogamic spo-rules through the atmosphere to such immense distances offer an insuperable difficulty to either view. It will be my duty to show you, that odorous particles projected from bodies have been conveyed to miraculous distances; and facts, well known to mariners off the coast of Africa, have exhibited, that far grosser particles have been borne on the air hundreds of miles from the place whence they proceeded. Mr. Charles Darwin, the distinguished naturalist, who sailed round the world about fifteen years ago, in her Britannic Majesty's Ship Beagle, states, that the atmosphere of St. Jago, the chief island of the Cape de Verd archipelago, is generally hazy; and this is caused by impalpably fine dust, which was found to have slightly injured the astronomical instruments. The morning before they anchored at Porto Praya, he collected a small packet of a brown-coloured fine dust, which appeared to have been filtered from the wind by the gauze of the vane at the masthead. Mr. (now Sir Charles) Lyell, also gave him four packets of dust, which fell on a vessel a few hundred miles to the northward of the Cape de Verd Islands. This dust Mr. Darwin sent to Professor Ehrenberg, who found, that it consisted, in great part, of infusoria with siliceous shields, and of the siliceous tissue of plants. In five small packets forwarded to him he ascertained no fewer than sixty-seven different organic forms. These infusoria, with the exception of two marine species, were all inhabitants of fresh water. Mr. Darwin has found no less than fifteen different accounts of dust having fallen on vessels when far out in the Atlantic. From the direction of the wind whenever it has fallen, and from its having always been observed during those months when the harmattan is known to raise clouds of dust high into the atmosphere, it

may be affirmed that it all proceeds from Africa. It is, however, a very singular fact, that although Professor Ehrenberg knows many species of infusoria peculiar to Africa, he found none of those in the dust sent him by Mr. Darwin, whilst, on the other hand, he found in it two species, which he had previously known as living only in South America. The dust falls in such quantities as to soil everything on board, and injure the people's eyes. Vessels have even run ashore, owing to the obscurity of the atmosphere induced by it. It has often fallen on ships, when several hundred, and even more than a thousand miles from the coast of Africa, and at points sixteen hundred miles distant in a north-and-south direction. In some dust that was collected on a vessel three hundred miles from the land, Mr. Darwin was much surprised to find particles—blocks—of stone, above the thousandth part of an inch square, mixed with finer matter; and he properly states that "after this fact, we need not be surprised at the diffusion of the far lighter and smaller sporules of cryptogamic plants."

The microscope has, of late years, unveiled the cryptogamic origin of many diseases whose nature had never been suspected. The results of modern inquiries on this subject, in connexion with his own views in regard to the hypothetical origin of yellow fever, will, I trust—for I have listened to them with pleasure and profit—be placed before you by an able colleague.* I may, however, briefly instance one highly curious example of fungous vegetation,—that of the *Torula cerevisiæ* or "yeast plant." Microscopic examination shows that yeast consists of a number of minute distinct vesicles, which appear to constitute one of the simplest forms of vegetation. When these are placed in a fluid in which any kind of saccharine matter is contained, and in a warm atmosphere, they vegetate actively, and assist in producing the process termed *fermentation*. If a small portion of the fermenting fluid be examined, from time to time, with the microscope, each of the minute vesicles is seen to put forth one or more prolongations, which, in time, become so many new vesicles; and in this manner an extensive multiplication of the vesicles ensues. I shall not

* Dr. Mitchell.

inquire here as to whether the yeast plant is to be considered the sole cause of the fermentation. Certain it is, that the rapid development of the cryptogamic plant is one of the most remarkable phenomena. It would seem, however, that putrefying blood, white of egg, flesh and cheese produce the same effects in a solution of sugar as yeast or ferment; and it is worthy of remark, that when the fermentative process, induced by yeast, is finished, thirty times as much yeast has been produced as was added to the solution of sugar or sweetwort.

How analogous the phenomena that are presented in a case of small-pox induced by inoculation! A minute portion of variolous matter is inserted under the cuticle of the arm, and in a period, which can be accurately foretold, the virus is found to have become multiplied in an infinitely larger quantity than in the case of the yeast plant; and in a manner, which does not permit us to doubt, that the process has been one of reproduction, and, therefore, a function of organized existence; for how—I repeat—can we conceive of an inorganic substance multiplying itself, when received into the animal economy!

But the theme is endless; the illustrations countless. The true philosophy of the science of medicine consists in a knowledge of the phenomena, and of the laws of the phenomena presented by man in health and disease. The healthy condition—with its relations to pathology, to the circumstances intrinsic and extrinsic that tend to preserve it, and restore it when disturbed—belongs to the department over which it is my duty to preside in this Institution. It is a noble study; and if you will honour me with that respectful attention which has been for so many successive years bestowed upon me by your predecessors, I can promise you a rich repast,—not from the mode in which the viands may be placed before you, but from their inherent excellence.

It has been well and charmingly said by one, who is himself distinguished as a physiological observer and reasoner,* that none but those who have tried the experiment can form an estimate of the pleasure which the study of nature,—physi-

* Dr. Carpenter.

ology, that is, in its wide acceptation,—is capable of affording to its votaries. "There is," he remarks, "a simple pleasure in the acquisition of knowledge worth to many far more than the acquisition of wealth. There is a pleasure in looking in upon its growing stores, and watching the expansion of the mind which embraces it, far above that which the miser feels in the grovelling contemplation of his hardsought pelf. There is a pleasure in making it useful to others, comparable at least to that which the man of generous benevolence feels in ministering to their relief with his purse or his sympathy. There is a pleasure in the contemplation of beauty and harmony wherever presented to us; and is not this pleasure increased, when we are made aware, as in the study of Nature we soon become,—that the sources of them are never-ending, and that our enjoyment of them becomes more intense in proportion to the comprehensiveness of our knowledge? And does not the feeling, that we are not looking upon the arts or inventions of a skilful human artificer, but studying the wonders of a creative design infinitely more skilful, immeasurably heighten all these sources of gratification? If it is not every one who can feel *all* these motives, cannot every one feel the force of *some?*

"But it is not only in affording us such interesting objects of regular study, that the bounty of Nature is exhibited. Perhaps it is even more keenly felt by the mind, which, harassed by the cares of the world, or vexed by its disappointments, or fatigued by severer studies, seeks refuge in her calm retirement, and allows her sober gladness to exert its cheering and tranquillizing influence on the spirit."

"With tender ministrations, thou, O Nature,
Healest thy wandering and distracted child;
Thou pourest on him thy soft influences,
Thy sunny hues, fair forms, and breathing sweets,
The melody of woods, and winds, and waters,—
Till he relent, and can no more endure
To be a jarring and a dissonant thing
Amidst the general voice and minstrelsy,—
But bursting into tears wins back his way,
His angry spirit healed and harmonized
By the benignant touch of love and mercy."

COLERIDGE.