ADDRESS

THE HONOURABLE DR. ROLPH,

DELIVERED BEFORE THE

Faculty and Students of Medicine,

IN

TORONTO.

TORONTO:

PRINTED BY T. C. BENTLEY, AT THE CHRISTIAN GUARDIAN OFFICE, NO. 9, WELLINGTON BUILDINGS, KING STREET.

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To

THE HONORABLE JOHN ROLPH, M. R. C. S. E.,

Professor of Surgery &c.

SIR,

At a very numerously attended meeting of the Medical Students of the University of Victoria College, held this day, we were deputed to present to you their request, that you will favor them with the manuscript of your Introductory Lecture, delivered at the commencement of the present Session, in order that it may be published.

Without attempting to eulogize, we, on behalf of the class may be allowed to say, we desire the publication of your lecture, on account of its intrinsic excellence. We were at the time of its delivery impressed with its polished elegance, its philosophic clearness, and the multitude of important facts which it presented, facts which belong not to the profession exclusively, and which cannot be too extensively known, or too deeply pondered.

But, as Students, we especially desire its publication in order that we may preserve it as a memento of yourself personally and of the course of Lectures we are now attending.

We feel assured that the numerous members of the profession, who have received their education at the Toronto School of Medicine, and are now practising with success the healing art (several of whom have already attained an eminence of which they and yourself, and colleagues may well feel proud), will hail with pleasure the Introductory Address of the Session of 1854-1855; and preserve it as a remembrancer of those studies made pleasant and successful by your valuable aid.

We avail ourselves of this opportunity of expressing our respect for those intellectual faculties, and our admiration of those high attainments which have justly placed you in the first rank of your profession; and our appreciation of

those labours which have indissolubly connected your name with the advancement of Medical Philosophy in Canada.

Trusting that you will accede to our request,
We are,
Yours, &c,

Committee.

J. G. GREY.
R. I. HICKEY.
JAMES DICKSON.
JOHN LENNON.
A. E. FORD.
A. J. PARK,
JOHN BENTLEY.
E. W. GUSTIN.

TORONTO SCHOOL OF MEDICINE,
Feb. 12, 1855.

REPLY.

TORONTO SCHOOL OF MEDICINE,
Toronto, 12th Feb., 1855.

GENTLEMEN:—

Although I with pleasure meet your wishes, because they are your wishes, for the publication of the introductory Lecture, yet I am not insensible to the overestimate, which your kind feelings have formed of it.

I fully share the pride and satisfaction you express at reviewing the success of our past labors, a success which is seen and felt in every section of the country, through the living evidence of your everywhere respected predecessors, now engaged in the pursuit of their noble and humane profession.—And I see with present abundant assurances, future accession of character and usefulness to the school, when you carry with you abroad the fresh fruits of your meritorious assiduity, your honorable emulation and trustworthy acquirements.

I feel the far too generous manner in which you refer to me personally; and I shall cherish it as an incentive to untiring labor with you and your successors in scholastic and professional life.

I am,
Gentlemen,
Your faithful servant,
JOHN ROLPH.

To Messrs. GREY, HICKEY, DICKSON,
LENNON, FORD, PARK,
BENTLEY AND GUSTIN.

INTRODUCTORY LECTURE, &c.

There is something serious and even solemn in the commencement of a Session. We are about to study the most exquisite work of creation, the human body,—the derangements to which it is liable, and the means of restoration placed in our hands.

It seems impossible to become acquainted with the laws of nature, to observe effects and causes, to trace a multiplicity of means and ends, of purposes and adaptations, without recognizing a Supreme Agent, by whom all these things are ordered aright.

There are, however, some minds so singularly twisted, that they are ashamed to regard the higher departments of knowledge in this manner. They deem it a weakness; and even arrogate to themselves a superiority, an exemption from views, which, because they irresistibly occupy the great bulk of mankind, they esteem vulgar.

True, indeed, it is, that the natural constitution of man leads him

"To look thro' nature up to nature's God."

And it is only the blindness of ignorance and the perversity of arrogant conceit, which sometimes sadly shroud our ulterior and more glorious views.

Heathen mythology puts this narrow and sceptical method of inquiry to the blush.

"Lo, the poor Indian whose untutored mind,
"Sees God in clouds and hears him in the wind."

And when the most uncultivated of our race, can thus in the rough outline of clouds and in the voice of the tempest, eagerly catch a glimpse of Him

"Who rides the whirlwind and directs the storm,"

we should ill deserve or improve our opportunities of extended knowledge and research, if we failed in our pursuits to decipher those sublime indications which are written with the Finger above.

The high and honourable profession into which you propose to enter, requires, when properly pursued, a vast amount of close application and intellectual acumen. All the sciences are tributary to the healing art, and all the powers of the mind are exercised in it. The science of medicine is, especially, the science of life. Besides chemical, physical and metaphysical philosophy,

all animated nature is your legitimate domain. In the laboratory of the chemist, it is true, we see much that is wonderful. We there see exhibited laws of affinity, and modes and proportions of combination between different bodies, from which result new substances possessing various properties; all, however, strictly appertaining to inanimate matter. But in the living laboratory, we observe not only new properties, but new powers, transcending everything of human origin, by which all nature is preserved in freshness and vigour, and extended from generation to generation, and from age to age.

Let us to-night enter the Temple of Nature, and take a general view of the wisdom, beneficence and unity displayed in the creation of all living things.

Among the most curious and striking properties of all living matter, both in the vegetable and animal world, may be noticed its resistance of the putrefactive process.

We see all nature teeming with life, from the oak of the forest to the flower of the field; from man the lord of creation, to the motes, which are said, to people the sunbeam; and after maintaining, for a longer or shorter time, a successful struggle against those chemical affinities, which lead to spontaneous decomposition, they all become indiscriminately involved in total disorganization. The living materials are dissolved and reduced to the common elements of inanimate matter. We see the foliage of this season about to decay and become the pabulum for the verdure of another year. Pope thus expresses it:—

"See dying vegetables life sustain,
"See life dissolving vegetate again;
"All forms that perish, other forms supply,
"By turns we catch the vital breath and die."

The range of temperature most favourable to the putrefactive process is between 86° and 100° of Fahrenheit's thermometer. But this includes the usual standard of heat in warm blooded animals; and hence we find them continually exposed to a degree of heat most conducive to this chemical change, and yet effectually resisting it. It is only after vitality is lost that putrefaction begins. Life therefore is conservative; it counteracts the tendency to spontaneous decomposition in the animal and vegetable kingdoms.

Life is not always as evanescent as the more obvious course of nature would lead us to expect. Indeed, a dormant vitality may exist in a system of organs for an indefinite period, and all the energies and functions of life be again called into play by heat and moisture. The germination of seeds, after being kept for years, is matter of daily observation. Some seeds of Egyptian wheat found in a state of preservation with a mummy, have been introduced into England, have germinated, and are yielding their increase. From this reproduction, successive crops are expected, till the world can be supplied

with a kind of grain, which had been buried for ages; but still possessing susceptibility to culture. This is like the death, burial and resurrection of a vegetable.

But the revivification of animalcules, is a phenomenon more curious; for it takes place more rapidly and is more striking in its results. The vibrio tritici, or the animalcule resembling an eel in its shape, which infests diseased wheat, and which, when dried, appears in the form of a fine powder, resumes its living and active state on being moistened. The gordius aquaticus, or hair worm, inhabits stagnant pools, and will, when the water is evaporated, remain in a dry and apparently lifeless state; but it will, in like manner, revive, in a very short time, on being again immersed in water. The same phenomenon is exhibited by the filaria, a thread-like parasitic worm, infesting the cornea of the eye of the horse. The rotifer redivivus, or wheel animalcule, which was first observed by Lewenhoeck, and was afterwards rendered celebrated by the experiments made upon it by Spallanzani, can live only in water, and is commonly found in that, which has remained stagnant for some time in the gutters of houses. But it may be deprived of this fluid, and reduced to perfect dryness, so that all the functions of life shall be completely suspended, yet without the destruction of its vitality; for these seeming atoms of dust, after remaining for years in a dry state, may be revived in a few minutes by being again supplied with water. This alternate suspension and restoration of life may be repeated, without apparent injury to the animalcule for a great number of times.

When I see these living beings reduced to dust, and remain for years or centuries, like inanimate atoms; and yet, by the sprinkling over them of a little water, brought into the manifestation of life and renewed existence; why should I doubt the truth, that a higher order of beings, man himself, after the lapse of the appointed time, should rise from the tomb, renewed in his nature?

Another remarkable circumstance distinguishing living from dead matter is the power it possesses of resisting, to a certain extent, the changes of external temperature. Immersed, as most animals are, in a medium colder than themselves, it is obvious that they would, by the laws which regulate the radiation of caloric, be soon reduced to a corresponding temperature. The fact that they sustain a degree of heat beyond the element in which they live, proves that a provision has been made for sustaining the internal temperature of animated nature; and this provision is so made, both with respect to the animal and vegetable kingdoms, as to be conservative amidst antagonistic circumstances, and meet the general range of contingencies incident to living Beings. It has been remarked that the roots of wheat, having shot into ice, thawed it. Perhaps the heat in the operation of malting, is generated by the

powerful germination which goes on. You may observe, too, the more speedy melting of snow when in contact with the leaves or stems of plants, than when lodged upon inanimate substances, provided the frost has been sufficiently permanent to cool those substances thoroughly. John Hunter appears to have detected this heat by a thermometer applied in frosty weather to the internal parts of vegetables newly opened.

The most remarkable account of the production of heat in plants is that given by Lamarick, of the arum maculatum (the white veined variety) the flower of which, at a certain period of its growth, he asserts to be for a few hours "so hot as to seem burning". An eminent botanist of Geneva, upon an examination, discovered that the heat began when the sheath was about to open and the cylindrical body within just peeping forth; and that it was perceptible from about three or four o'clock in the afternoon till eleven or twelve at night. Its greatest degree was seven of Reaumur's scale above the heat of the air, which at the time of the observation was about 14 or 15 of that thermometer.

You will observe, then, that it is one of the essential properties of the vital principle to preserve all animated nature from the ruin of chemical decomposition, while it at the same time sustains the very temperature most conducive to that change.

It cannot be misplaced for me here to ask, how any men with a sound condition of intellect, can ascribe the acquisition of this peculiar endowment of living matter to habit or to chance. It is easily conceivable that matter should become accommodated to the same standard of heat as is found in the surrounding medium. It is the very rule of equalization observed to exist between inanimate substances; but how could chance produce the exception to that rule? It is not an acquiescence with the known tendency of things; in which case such bodies would proceed to putrify if they retained their temperature, or in our winter weather to freeze as they gradually lost it: but it is an opposition to such tendencies, a resistance of the very condition to which living bodies continually tend. Hence a philosopher once called life a *forced state*. We cannot here fail to recognise the super-addition of properties designed for the preservation of all animated nature by Him who created it.

There is another striking fact of an opposite character. All living beings, including vegetables, besides the above power of preserving their temperature in a cold medium, are also enabled to preserve it in a medium of otherwise most destructive heat. It is a strange chance which could so kindly and singularly provide for and bestow upon all sentient nature for its welfare, the

power of withstanding two opposite and conflicting extremes; extremes, too, which unceasingly tend, with all the force of the laws of chemical affinities, to involve such bodies in destruction.

Tillet and Duhamel long since gave an account of some young persons who were in the habit of going into the heated ovens in order to prepare them for the reception of the loaves. The temperature to which they were exposed, appears to have been, in some cases, as high as 278°, being considerably above the boiling point; and it is said they were able to endure it for twelve minutes without material inconvenience, provided they were careful not to touch the surface of the oven. This account was discredited, till it received confirmation from the experiments of Fordyce, Blagden and others. A chamber was heated considerably above boiling water, in which these experimental philosophers declared they could enjoy themselves pretty comfortably. Although this extraordinary capacity to endure a transition into so high an artificial temperature, may be partially accounted for upon the increased evaporation from the cutaneous and pulmonary surfaces, yet it seems to afford alone an insufficient explanation. There must be, connected with the living system, some functional process of refrigeration, not at present understood. Man and many other animals are subject to great transitions; and it is to meet the exigencies from such changes, that the system is endowed with the power, on the one hand, of evolving more or less heat according to the demand; and on the other hand of inducing the opposite condition of cold, perhaps by rendering the superabundant heat in some way latent upon any emergency. Upon whatever principle this accommodation to opposite extremes may be explained, it certainly indicates a nice adjustment of the vital operations by the Creator to the wants of the animal economy and to its varying and even opposite necessities.

Perhaps I have dwelt too long on this subject; but I cannot forbear to draw your attention to the uniformity with which the production of temperature is carried on, and the merciful limits within which the range of its variation is confined. Although millions in one region and another are preserved in comfort by the fidelity of its supply, yet how seldom do you see, in the whole world, an example of death from the mere want of generated heat, or from its consuming excess. Sometimes, indeed, you see an undue quantity evolved, when it forms one of the most prominent symptoms in some fevers, and from which the name fever is derived in all languages. But the highest degree to which the heat rises in fever is 110° or 112°; and this excess is generally within the control of the medical art. This is not, however, nature's appointed limit in some rare cases, when human folly has provoked her fire and outraged her economy. In such cases morbid heat has been carried to combustion. Narratives of such events not unfrequently occur in the

annals of medicine, and Plouquet enumerates twenty-eight of them in his literatura medica. In all such instances, these victims have induced their own awful fate by long continued habitual excess. The habitual use of ardent spirits in any sensible quantity, impairs in a greater or less degree the energy of life, the preservative principle of the frame; but it is only from these transcendent excesses, that the kindliest laws of the animal economy become so wofully excited and deranged, that the very process ordained for the due preservation of animal heat, involves the whole body in self-conflagration. Had chance or atheists created man, our bodies would be burnt as often as our houses.

The power of assimilation is another peculiar attribute of life.

Inanimate substances increase by accretion. We see this illustrated in various ways, in the process of crystallization, in the incrustation of bodies, and in the formation of petrefactions. But in living beings, it is the laying hold of some pabulum and converting it into new material. It is an animal chemistry; and it transcends the laboratory. It is always associated with life, and never exists without it.

The aliment, no matter whether animal, vegetable or mixed, is converted into matter of the same chemical character. The flesh and bones, for instance of an ox, subsisting on pure vegetable food, of a lion, subsisting on pure animal food, and of a hog, subsisting on mixed food, though differing in some of their sensible qualities, are identical, considered as chemical compounds. This transformation of the aliment into the elements of the living body, is one of the greatest wonders in this economy.

It equally exists in the vegetable as in the animal kingdom. A plant, it is true, is unfurnished with a stomach to digest, or auxiliary organs to prepare the elements for new formed blood. But the whole process with them, though similar and dependent upon a less complicated apparatus, is equally efficacious in effecting assimilation. The sap vessels by their cellular extremities absorb the nutritious fluids afforded by the soil. In their passage through the root a change takes place; for there is evidently a great difference in many cases between the fluids of the root, at least the secreted ones, and those of the rest of the plant; and this justifies the presumption that some considerable alteration is wrought in the sap in its course through that important organ, which obviously serves a higher office than merely sustaining a fixed position. From the roots it passes through the stem or trunk by a continuation of the same vessels, and is conveyed into the flowers and the fruit; but by far the greater part of the sap is carried into the leaves, a part whose importance Mr. Knight has most satisfactorily shown. In these organs the sap is exposed in its transit through the expanded leaves, to the action of light, air and moisture, three most powerful agents. During this ventilation much

superfluous matter passes off, and the fluid becomes more fully and completely elaborated. It is then returned by another set of vessels into the new layer of bark, which they nourish and bring to perfection, and which is enabled in its turn to secrete matter for a new layer of alburnum the ensuing year.

From this summary view of the vegetable economy, it appears to consist of a vascular system, that is, of living tubes without any acknowledged nervous system. These ligneous vessels are no sooner imbued with life, than a new order of things arises, and new phenomena are presented. They can, then, assimilate, each plant to itself from the same aliment, the most heterogeneous elements, control all the affinities so powerfully displayed in the chemical relations of inanimate matter, and transform the noisomeness of the dunghill into the fragrance of the violet, and the exquisite delicacy of the lily. All this, I say, arises from the existence of life in the organised structure.— Destroy the vitality, and all these wonders perish with it; and the very light and air and moisture, which were subsidiary to the living principle, manifestly tend, when emancipated from its control, to hasten the drooping plants into aridity and decay.

From these living processes there is to be found as much diversity of results in the plant as in the animal. Simplicity of organization does not seem to impair these powers of transformation. Thus the root of the mimosa nilotica smells like assafœtida, but the flower emits a very agreeable odour. The stem exudes the bland well-known gum arabic, but the juices which it contains are sour and astringent. Plants draw their materials from the earth; and metamorphose them into the varied constituents and products we find in them. Even the earth and metals in their composition appear to be originally formed out of the elements by the power of the organs. Schrader has made some very interesting experiments on this subject. He sowed in sublimated sulphur several species of corn, sprinkled them with distilled water, and prevented dust or any other foreign body from approaching them. In this condition they had access to no other pabulum than the sulphur, the distilled water, the air and light with other imponderable elements. And these species of corn had the same constituents, the same kinds of earth and metal, viz: iron and manganese, as are found in the culm and ears of those, which luxuriate upon their natural food. Abernethy obtained by his experiments, vegetables which had manufactured their constituents out of water and air. You may regard, therefore, the vegetable kingdom, as the appointed agents for conducting the primary vitalizing process, for bringing inorganic matter into the sphere of life and making it amenable to the powers and tributary to the nourishment of the higher kingdom. For while plants can live upon, transform and assimilate the ruder elements of

matter, animals can only live upon, transform and assimilate, what plants have first thus vitalized. This affords the only true line of demarcation between the two kingdoms of living nature.

In the selection of food for assimilation by animals, there is a divine regard to the wants and immunity of man. Both in the choice of food and in its appropriation to the process of nutrition, they are rendered to us safe contributors. They either eat that which is innocuous, or they appropriate to the nourishment of the body only what is so; while the depurating organs prevent the blood from being so charged with noxious elements as to destroy the vital balance and give the mastery over the law of healthy nutrition.— Unguarded by this instinct or exposed to the issues of a less beneficent regard to the character of the diversified food in nature's abundant larder, we might be often doomed to see, as in the Western States, the Trembles from the Indian Hackey among the cattle, and the like disease from eating them. It is only, when, in these rare exceptions, we see the value of the divine arrangement and adaptation, that we cease to live in a thankless immunity. Hence may have arisen the physical reason (whatever other existed) which directed the Mosaic Law against feeding on blood or animals strangled. The exsanguineous parts on which we feed are vitally extracted from the half depurated blood, as the bee extracts honey from the poisonous flower. But were mankind to partake largely of blood, always with many morbid elements in it, no one can estimate the malignity of the evils that might spring from it. The Bible and the pathologist would prescribe the same law.

All living nature breathes.

Respiration, obviously necessary for man and other animals, is not less so for vegetables. The organs adapted to their function vary throughout nature; but they are always suited to the being on which they are bestowed, and are directed to the fulfilment of a common purpose.

The internal surface of the lungs or air-cells in man, is said to be equal to the external surface of the whole body, or about fifteen square feet. On this surface the blood is exposed to the influence of the respired air, through the medium, however, of a thin pellicle, and undergoes changes so necessary to existence, that we can live scarcely a minute without this wonderful process.

The leaves of plants seem to be their breathing organs; and they present a very extended superficies, well adapted for the purpose of exposing the vegetable juices to the influence of the air. Their upper surfaces, generally covered with a smooth, polished cuticle, form the respiratory portion. The absorbent vessels of the roots, carrying sap, unite at the foot-stalk of the leaf,

forming a vascular bundle, which spreads the sap in its numerous ramifications on the upper surface of the leaf, where it changes its colour and properties, becoming vegetable blood. These ramifications terminating in returning vessels which collect again at the footstalk of the leaf and thence radiate, and disperse the aerated blood, upwards to the bud and downwards to the roots, to be expended in the various secretions, nourishment and growth of the plant.

The arterialization, then, of the sap in the leaves, corresponds to the arterialization of the venous blood in our lungs. But in carrying out this elaborating process, each kingdom is made to minister to the other. During respiration we carbonize the atmosphere, and consume its oxygen, well called, vital air; plants reverse the order, and emit the oxygen we need, and consume the carbon we disengage. Both the living kingdoms breathe and live by the same atmosphere; but instead of exhausting the vital element, they are made by their combined operation to keep it in freshness for each other.

Here we have, on a vast scale, a kind of arrangement which evinces both benevolence and design. Were animals and plants sustained by the consumption of the same aerial principle, the vital sources about us would soon be diminished, and the animal creation dwindle till it became extinct. Even were man alone to consume the air without a provision for its renovation by the processes of vegetation, the same decay and ultimate extinction would be equally certain, though more remote. But He who created these things, designed their perpetuation, and provided the means. He has made the two kingdoms, by their respective vital operations, keep each other alive.

There is another relation of harmony between animals and plants, which is not the less deserving of your admiration, because it is less regarded. Perhaps all men admire, as well as enjoy, the luxurious and varied food which plants afford them. But who admires the poisons they yield? Yet these poisons are the invaluable articles of our materia medica.

The vegetable world is suited to man in *all* his conditions. He needs food; and therefore esculents are provided for him. He needs, moreover, medicines; and many classes of medicants are provided for him. In his primitive state, before sin introduced disorder, he needed food only; and it is probable that vegetables, then, belonged only to that class. By his fall he "brought sin into the world and all our woe"; and coeval with this melancholy change, was, probably, the superaddition of the healing productions.—Hence, after the fall, the earth was *cursed*, and new productions and new ingesta are announced—"Thorns also and thistles shall it bring forth to thee; and thou shalt eat the herb of the field."

This curse, remember, is not to be viewed as a mere manifestation of divine displeasure. With the judgement there was mercy. The alteration in nature was adjusted to the alteration in man's condition. There arose with his new wants, a new provision for them. Had fallen man been doomed to live in the primeval world, he would have found no remedial agents; it was, therefore, cursed *for his sake*, i. e. to meet his exigencies.

Observe, too, in how many and varied particulars, this healing relation is established. There are many diseases; and there are many remedies. In the body there are various organs; and there are various remedies furnished to act specifically and suitably upon each and all of these organs. Upon this divine adaptation of remedial agents to the different structures, is generally founded our therapeutical classification. Thus, we have cathartics, acting on the intestines; emetics, acting on the stomach; diuretics, acting on the kidneys; and many others, all endowed with the power of exercising a remedial action on particular parts of the animal economy.

Nor is this all. There are certain refinements in disease; there are various modifications of every organic derangement; and therefore any one remedy would be inadequate to meet such diversities. Here again nature is beneficent. You meet with shades of difference, for example, in every pulmonary disease; and you meet with the needful shades of difference in the remedies. Hence you have *different kinds* of expectorants, of diaphoretics and of cathartics; and the like holds true of all our medicines. Praises are lavished upon the physician who nicely adjusts the remedy to the state of the disease. It is well. But do not forget the adoration due to Him, who, in framing nature, has been so mindful to suit the resources of the other kingdom to our own; to make the productions of the earth tally with the wants of man; to establish appetencies, without which medicine could be neither a science nor an art.

How close is this fitting of one department of nature to another! Of how many refined particulars it consists? How nicely must the nerves of an organ be constructed, to answer so perfectly to many external agents, each destined to act in its own peculiar way upon it.

Viewed alone, it might not, to some minds, seem matter of wonder, there should be many different plants with many different properties. Viewed alone, it might not seem matter of wonder, there should be many diseases, and each disease consist of many varieties. But it is truly wonderful that in another world of living things, viz., the vegetable kingdom, we should find them imbued with various properties, and modes of action, and diversified action too, *just* adapted to another and higher world of living beings. And

how adapted? To diminish suffering; to alleviate every variety of disease; to allay the severity of pain; indeed, to minister to the whole complicated catalogue of terrestial woe. It puts the shallow sceptic to the blush. It is a wonder that rushes a belief into the mind that there is about the matter an unseen power replete with wisdom and beneficence—a creator, by whom must have been ordained this external and internal world of wonders,—wonders which thus challenge our reason and awaken our admiration; which answer to our sorrows, and therefore kindle our gratitude.

This arrangement of the economy of nature, in multifarious particulars, to the exigencies of man, harmonizes with divine truth. Both natural and revealed religion acknowledge the existence of evil. And both proclaim an anxious, abundant and careful provision of remedy for it. Had we to enumerate human diseases, and close the sad catalogue with the remark,—there is not a single palliative to be found in the whole range of creation,—it would be difficult to meet with human logic the infidel objection, that the economy of nature and the economy of redemption were not stamped with the evidence of a common origin. But on the contrary, we see that He who has allowed the evils (evils, too, in 999 cases out of a 1000 of our own production) has himself provided us with remedial agents. How evil came into the world no man can tell, beyond what is revealed; but we do know that all nature is framed with the view of removing or alleviating it. There is no ground for saying of anything around us, that it is intended or constructed for our injury; —for example, that poisonous vegetables are intended to poison us. On the contrary the whole face of the earth is rich with redeeming means. The evil seems permitted, not contrived. The good is the offspring of creative benevolence and supreme wisdom. Hence learned divines often draw their analogical arguments from our profession, and justly argue a reasonable belief that He who has made such provision to repair the physical condition of man, has made the revealed provision for his spiritual fall.

The power of propogation is displayed throughout animated nature.

You find the two sexes, either existing together in the same, or separately, in different plants. The anthers have been proved by many experiments to be necessary to the fecundation of the vegetable seeds by the farina, or dust, which they disperse, and which adheres to the moist stigma on the summit of the style or pericarp. The amatorial attachment between these stigmas and the anthers on the summits of the stamens, has attracted the notice of all botanists. In many flowers, the anthers or males, bend into contact with the stigmas or females. In the kalmia, the ten stamens lie round the pistil, like the radii of a wheel, and each anther is concealed in a niche of the corol to

protect it from injury; these anthers rise separately from their niches, and approach the stigma of the pistil for a time, and then recede to their former situations. In the fritillaria persica, the six stamens are of equal lengths, and the anthers lie at a distance from the pistil; of these, three alternate ones approach first and surround the female; and when these decline, the other three approach; and in parnassia, the males alternately approach and recede from the female. And lastly in the most beautiful flowers of coctus grandiflorus, and of cistus labdaniferus, when the males are very numerous, some of them are always bent into contact with the female; and as some recede others advance. In other flowers, this course is reversed, and the females, not over modest, bend into contact with the males. The female of the epilobium augustifolium, willow herb, bends down amongst the males for several days, and becomes upright when impregnated. In the spartium sesparium, common broom, the male or stamens are in two sets, one set rising a quarter of an inch above the other. The upper set does not arrive at maturity so soon as the lower; and the stigma, or head of the female, is produced amongst the upper or immature set. But as soon as the pistil grows tall enough to burst open the keel-leaf, or head of the flower, it bends itself round in an instant, like a french horn, and inserts its head, or stigma, amongst the lower or mature set of males. The pistil, or female, then continues to grow in length; and in a few days the stigma arrives again amongst the upper set, by the time they become mature. This wonderful contrivance is readily seen by opening the keel-leaf of the flowers of broom, before they burst spontaneously. And lastly, in the collinsonia, the two males widely diverging from each other, the female bends herself into contact first with one of them; and after a few days leaves this, and applies herself to the other, the anther of which was not mature so soon as the former.

Every care is shown for the dispersion of their prolific dust. Where the male and female are not sufficiently near, the anther bursts and diffuses the farina; or it is wafted by the winds even for miles; or carried and applied by insects.

You observe then, a striking analogy between the sexual systems and fecundating processes in animals and vegetables; and were this the proper time for pursuing the subject more minutely, still closer analogies might be pointed out as we approach the confines of the two kingdoms.

There is throughout this economy of plants and animals, such a unity of plan, such analogy of means amidst diversities of structure, such multifarious contrivances for vital purposes, associated with corresponding adaptations to

the well being of the animated world;—that one would think even a sceptic introduced into the Temple of nature would be obliged to exclaim "surely a supreme first cause dwells here."

Connected with the laws of propagation displayed with so much unity in both kingdoms, is the provision every where found for the helplessness of infancy. Do not think it merely fanciful to trace analogies in the vegetable, though they are somewhat less obvious than in the animal world.

Galileo, when a martyr of Truth, took a straw from his poor yet glorious bed, and holding it up, declared, *that it contained in itself the proof of a Divine Creator.* And I should entertain but slender respect for your pretensions to collegiate honors in your profession from the universities of your country, if you could devour your eggs at breakfast without a passing admiration of the shell.

But as the embryo animal is thus safely encrusted, so you see the kernel of fruit alike secured in its shell; and grain carefully encased in its husk. There is seen not merely contrivance for the developement of the vegetable embryo; you also see care bestowed to promote and insure the further consummation. I never see the common sun-flower with its bosom crowded, as it were, with its maturing offspring, and this offspring by the revolution of the parent from East to West constantly exposed to the genial rays of the sun through his diurnal course, without irresistibly thinking of the patient incubation of the Bird, the defence of its young by the meekest animals, and the enraptured care and affection you have received from your mother.

Some might lightly call it *mere instinct* in plants and animals. Never be led away from the truth, by a name; rather ask in reply, who implanted that instinct? Who made it thus harmonise with the wants of living nature? Who established this overpowering relation between the imploring accents of the young and the responsive tenderness of the mother? Things could be thus wisely and harmoniously ordered, only by the eternal Parent of all.

Grant that it is instinct. But had not the God of nature added instinct to reason, the human race might long since have become extinct. The pains, the penalties, the toils, the cares, the anxieties of a *mother* are never adequately repaid by her offspring. Nothing, indeed, can repay what she undergoes for her children; and boasted reason would sink under the trial, or shrink from the duty, had not an omniscient Being infused into the mother's heart the irresistible instinct of the lioness, which prompts the savage animal to die in defence of its progeny.

In the savage beast the instinctive feeling soon ceases, and reason being absent, all sympathy between parent and progeny ceases also. Not so with woman. The primary instinct is never entirely obliterated; but, cherished through life by the nobler gift of reason, it maintains its way, even stronger than on the paternal part.

It is strange, says an elegant writer, that the ancient poets, when deifying so many meaner attributes of human nature, forgot *maternal affection*.— They have, as you know, clothed in divinity the barbarous monster, who slaughtered the children of Niobe; when they ought to have deified the parental agony, which the mother felt, and which the *marble* yet breathes forth! Our own immortal Poet, Campbell, has thus most beautifully personified the maternal love of offspring—

> " Lo at the couch, where infant beauty sleeps,
> Her silent watch the immortal mother keeps;
> And weaves a song of melancholy joy—
> Sleep, image of thy father, sleep my boy;
> Thy fame, thy worth, thy filial love, at last
> Shall sooth the aching heart for all that's past—
> With many a smile my solitude repay,
> And chase the world's ungenerous scorn away."

It might be said, there is too much of selfishness in these sentiments to make them perfect. Still they are true to human nature. Let the stoic exult in his cold criticism. Perhaps *even he* would feel the reflections, which the same Poet causes to pass through the mind of the mother when gazing on the unconscious child—

> " And say, when summoned from the world and thee,
> I lay my head beneath the willow tree,
> Wilt thou, sweet mourner! at my stone appear,
> And soothe my parted spirit lingering near!
> Oh! wilt thou come at ev'ning hour to shed
> The tear of memory o'er my narrow bed;
> Breathe a deep sigh to winds that murmur low,
> And think on all my love, and all my woe!"

There's a train of thought worthy of an immortal being. It is in itself indicative of immortality.

But what is the inference from all this? That from the shell and husk in the vegetable kingdom, through all the gradations and diversities of contri-

vance, in this world of wonders, up to the sentiments implanted in man, there are manifest indications of care for the embryo—for the young—for the most precarious and dependent states in animated nature. But our language is put to the blush by our ancient philosopher, who, enraptured by his survey of creation, exclaimed. "Thy tender mercies are over all thy works!"

Every living thing further possesses *the power of repairing the injuries and disorders incident to it.*

It is evident that the incessant friction and play of the joints would as soon wear out these parts, as the shoes you walk upon, were there not a constant supply and active transformation of the blood that renovates them. And were it not for the same repairing process, the superficial parts of the body would be exposed to rapid destruction from attrition; as is by Paley familiarly illustrated by the shortness of time in which skin in the form of a glove, is worn out; whereas the natural integuments of the hands are so constituted and renewed as to last for life.

You see the same vital energy displayed in combating and subduing diseases, and in the healing of wounds. It would profit a larger portion of the world, did they understand and properly appreciate the importance of preserving in freshness the powers of life by shunning whatever will impair them. For instance:—these restorative powers are most seriously injured by the constant use of ardent spirits and the use of tobacco, and are almost annihilated by continued excess. It is not, therefore, strange that the sober often survive the contest, while the drunkard sinks under the unequal contest. The body thus disarmed of its natural defence, falls an easier victim to the incursion and mortality of disease.

This truth is daily exemplified. A friend from an accident receives a slight wound upon the leg. It is neatly bound up by some kind matron of known country skill with some innocuous application. In a short time the parts unite, leaving only an obscure mark or scar to show forever after what healing nature once did for him. Another, of intemperate habits, receives a similar wound and treatment. If you examine it many days afterwards, you see the parts still unrepaired, but bearing evident marks of the *fruitless efforts* of nature to do it. The necessary inflammation has, indeed, been set up; but his own folly has doomed it to take place in a part rendered either unable to reach the healing standard or unable to sustain it. The surrounding parts, too, sharing the debility and depravity of the

general habit of the body, are unable to withstand the extension of this inflammation; and you, therefore, see a diffusive redness spreading more or less from the seat of injury, while the wound itself becomes ill-conditioned, and even offensive in its discharges. In fact the natural action set up to restore, is a greater labor, as it were, than the weakened parts can endure. It is a well-directed effort, not to be the less valued because it cannot succeed against such unnatural disadvantages. The kindest laws and vital processes are thus made, not only unavailing by his voluntary impairment of the system, but even productive of additional evil from the contiguous parts being unable to sustain the remedial process. In aggravated conditions the affection sometimes spreads over a limb, and the general system becomes deranged. The limb may and occasionally does become so diseased as to be worthy of amputation—but the surgeon pauses. If the system has been reduced to such a state that it cannot heal the wound, what must be his expectations under such a wound as amputation inflicts? Such a man does not so much prove the futility of the healing process and of the healing art, as the degree it is in his power to preserve or destroy their practical sufficiency or insufficiency in his own case by his own temperance or excess. But restore the debilitated powers of life, and the healing process will go on successfully, or only need a little assistance very intelligibly asked for, in the medical language of nature called symptoms.

The laws of life when directed to restoration are in many instances singularly adapted to the exigencies of the case. Matter collected in an abscess will work its way by gradual ulceration through considerable thickness of parts, in order to find an outlet consistent with the existence of the sufferer; when a membrane, not thicker than a piece of thin paper, interposes between it and an internal cavity, by discharging into which with such manifest facility, the patient would presently expire. This selective, or determinative, perhaps instinctive process of life, might be illustrated by a number of curious facts; and it can be satisfactorily accounted for in no other way, than regarding it as a law impressed upon life by the author of it.

Plants from their endowment with life, possess the like powers of restoration. If you bring together the lips of an incised wound in a tree, they unite, just as would the similar wound of an animal. This strictly vital process constitutes what is called ingrafting. A slip is taken and paired at the end into a triangular shape; this is inserted into an excavation made in another branch to receive it, so that the cortical edges of each may be in exact opposition. They are in this way bound together in surgical style, and may be truly said to unite by the first intention. Upon precisely the same principle

and in a similar manner, you can practise ingrafting upon animals. The surgeon thus supplies a man with a new nose, who has had the misfortune to lose it.

Vegetables, like ourselves, are subject to various diseases, and need, therefore, a physician. Without vegetables the animal creation could not continue to subsist; and hence the study of their morbid conditions, is worthy of every medical philosopher. To enter fully into the subject would occupy the whole season, and embrace all the elements of scientific agriculture. You can more properly pursue these interesting studies, if you have heretofore neglected them, after the completion of your professional education; and you will then be abundantly rewarded by a perusal of the dissertations of Linnæus, Spallanzani, Blumenbach and of Leibig at the present time. But we could scarcely take even a rapid glance at living nature without adverting to the common lot of bodily afflictions.

From disease or old age vegetables, like animals, *die*. The duration of life differs greatly in different plants. Some species of Boletus require only a few hours for their evolution and as soon again decay. They are like the ephemeral insects. Several fungi only live a few days, others weeks and months. Annual plants live three, four or at most eight months. Biennial plants continue sixteen, eighteen and even twenty-four months. Many herbaceous plants grow a few years, but several a long series of years. There are some shrubs and trees which can live from a hundred to a thousand years. With us the oak and lime-tree attain to the greatest age; the former may live six or eight centuries or more; and stems of the latter have been seen almost as old. But the trees, which, in our globe arrive at the greatest age, are beyond doubt the adansonia digitata, the pinus cedrus and the different species of palm. The adansonia probably lives the longest of all, as its age is computed to be even several thousand years.

It was once vainly hoped to elude the death or extinction of some kinds of fruit by engrafting. For this purpose a flourishing branch was taken from an old tree, and grafted into a young stem that had centuries to live. This branch, selected for its healthfulness, and thus associated with a youthful and durable support, was expected to share the longevity of the tree which had thus adopted it. When taken from its native growth, neither the eye nor the microscope could detect an element of early decay or dissolution; and, then, its vessels had inosculated with those of the new parent and derived from it new life and sustenance. All promised renewed longevity.

But the decree of death cannot be thus evaded. Every individual plant as well as animal, has a definite period of existence allotted to it, though some recent botanists have denied it. The graft is but the extension of the parent tree, and carries its destiny with it. Hence when the hour of death arrives, when the *natural* term of existence has expired, the whole dies, whether the parts are connected together or scattered everywhere over the world. The same, no doubt, holds true of all animals that can be propagated by subdivision or by lateral generation.

Thus the lateral propagation of the polypus found in the ditches in England in July, but more particularly that of hydra steutorea, is wonderfully analogous to this multiplication of a single plant into many. The hydra steutorea, according to the account of Monsieur Trembly, multiplies itself by splitting lengthwise; and in twenty-four hours these divisions, which adhere to a common pedicle, resplit, and form four distinct animals. These four in an equal time split again, and thus double their number daily, till they acquire a figure somewhat resembling a nosegay. The young animals afterwards separate from the parent, attach themselves to aquatic plants, and give rise to new colonies.

Blumenbach, in his treatise on generation, mentions a curious fact concerning the fresh water polypus. He cut two of them in half, which were of different colours, and applying the upper part of one to the lower part of the other, by means of a glass tube, and retaining them thus for some time in contact with each other, the two divided extremities united and became one animal. This is engrafting one animal upon another. Here we again see plants and animals in their vital properties approximating each other.

Wherever there is active life there is sleep. The state of excitement, of motion, of action, by which all living things subsist, cannot be continued without a daily suspension of some hours. We see this in all animals. All living nature sleeps. The perfect author of it is alone inexhaustible.

Vegetables sleep. Some close together the upper surfaces of their leaves, both during their repose and in rainy weather; as the sensitive plant, the kidney-bean, terminal shoots of alsine or chickweed. Many others close their petals and calyxes, as the convolvulus; and some, like the owl, even in the bright daylight, as tragapogon. At the approach of night you may see a whole field of daisies, closing their petals for repose, till the return of another day. It is, in part, by the alternate vital contractions and dilatations of the vessels that they propel the juices circulating through them. It is by a series of vital actions that the plant grows, the foliage is expanded, the buds are put forth, and matured into

flowers and into fruit. It is for the reparation of the expenditure incurred in these elaborate processes that we find plants adjusting themselves to rest and invigorated by it.

Vegetable irritability is seen in some flowers in a high degree; as in the barberry, whose stamens will bend and fold over the pistil if the latter is pricked. There is a plant whose leaves move without any assignable cause: it grows only on the banks of the Ganges; it has three leaflets on each foot-stalk, all of which are in constant motion. The fly-catcher, as it is commonly called, grows in the marshes of South Carolina. Its irritability is so great, that an insect which settles on it, is generally crushed to death by the collapsing of the leaves, which are armed with bristles to pierce the prey. Plants seem, too, capable of contracting habits. Thus the sensitive plant, if conveyed in a carriage, closes its leaves as soon as it is in motion. After some time, it becomes accustomed to it; the contraction ceases and the leaves expand. But if the carriage stops for any length of time, and recommences its motion, the sensitive traveller again folds its leaves till reconciled to its new situation. There is perhaps no vital phenomena in the animal, which is not found in the vegetable world. It is the spiritual part of man, which alone raises him above the very plants he feeds upon.

It would hence appear that these plants have not only muscles about the moving footstalks or claws of the leaves and petals, but that they must be endued with nerves of motion, and some would say of sense. When one part of a leaf of mimosa is touched, the whole leaf falls; there must, then, be a common point (which some venture to call a sensorium or brain) where the nerves communicate belonging to this one leaf-bud. If you slit a leaf-bud with a pair of scissors, some seconds elapse before it seems sensible of the injury, and then the whole collapses as far as the principal stem. If you put a small drop of sulphuric acid on the bud in the bosom of the leaf, you find that after about half a minute, when the nervous center may be supposed to be destroyed, the whole leaf falls and rises no more.

Facts of this nature have by some been considered as affording evidence of a sensorium, of a brain, and consequently of sensation and volition. Even Bishop Watson, I think, is pleased with the idea of all living nature being endowed with consciousness and sensibility, however low in degree. With these views, it would be no poetic fiction to say that the fields smile and the verdant hills rejoice.

Bear these points in mind when you study the nervous system of man; and you will, I think, recognise a close analogy to the reflex action of Marshall Hall.

Vegetable physiology has vastly contributed to our knowledge of animal functions. Upon this subject we are much indebted to M. Schwann, who not many years ago wrote a treatise to demonstrate the intimate relation in which the two kingdoms of organic nature stand to each other, by showing the identity of the laws of development of the elementary parts of plants and animals. The main result of the inquiry was that the law of development of the elementary parts of all organisms is the same, just as all crystals, however different in their forms, are developed in accordance with the same laws. And as cells constitute the elements out of which the vegetable structures are worked and by which, as subsequently proved, their nutrition, secretion and other vital functions are carried on; so by extending the inquiry it was found that the like cells in animals similarly elaborate their various tissues and accomplish the living chemistry going on within them.

What is true of infinitesimal animalcules is true of the infinitesimal cells, and, indeed, of the infinitesimal vital granules out of which the cells themselves are wonderfully formed. Among the infusoria, Cuvier names the homogenia, describing them as without viscera or other complication and frequently destitute of even the appearance of a mouth. Ehrenberg, it is true, has objected that they have a mouth and the greater part of them a digestive cavity complicated with many cœcal pouches or stomachs; and he has accordingly proposed to name the order polygastrica. But it is said that the appearance from which the existence of stomachs has been deduced, arises from globular particles floating and seen in their transparent bodies; that when touched with liquor potass they swell and burst, discharging their globules, which had been really floating in the interior; and that the latter touched with the same liquor, also swell and burst and discharge the granules they contain. These seeming stomachs would, therefore appear to be cells, through which is effected the needful assimilation, and which act like those of chyle and blood in the higher animals. Hence the homogenea present the lowest specimens of animal existence in the form of a cell maintaining its cell life, its nutrition and multiplication.

Upon the corresponding confines of the vegetable kingdom we meet with cell life and existence in the same simplicity and the same integrity. The red snow of the northern regions, derives its colour from the protococcus nivalis. Every crimson vesicle is an independent plant, endowed with the power of

maintaining its own existence, performing its vital functions and propogating its own kind. Sometimes we see cells pregnant with granules to be developed into a progeny of new cells; at other times, elongating and dividing, as if propogating by slips.

These wonderful developments and properties of microscopic beings (in both kingdoms bearing such close affinities and stamped with the impress of the same Creator) bring us to the confines of the inorganic world. And even there, under the gift of chemical in the place of vital affinities, we are wonderstruck with the beauteous forms and faithful crystallizations presented by the atoms, obedient to their law divine. When we thus trace the construction, the care and the properties, bestowed alike upon the microscopic world and upon all that we call great in the highest productions of creative wisdom in the earth or in the universe, we cannot fail to recognise the truth, that with respect to the Supreme Being the terms *little* and *great* can have no meaning, no relative bearing.

Life by its unity, and the comprehensiveness of its operation, bespeaks its origin. The same principle which vivifies the humblest germ in the vegetable catalogue, gives vitality to man. It is found alike in the minutest animalcule, and in the mammoth animals; in the seed and in the giant of the forest. It is conversant with all that is great and with all that is little throughout all the departments of animated nature. Here we see the utmost simplicity in the agent, and the most wonderful diversity in operation and effects.

You observe corresponding marks of divine agency in a kindred power in the physical world—that equally mysterious agent called *gravitation*.

Under its influence we witness alike the elevation of the ocean into oscillating waves, and the fluctuation of the least ripple upon the surface of a bason of water—the eruption of a volcano, and the effervescence of a mixture—the spherical shape of the earth, and of the globules of quicksilver scattered on a table—the rotation of a plant, and the spinning of a tetotum—the limitation of an equatorial sea, and of the pendulum of a clock—the tremblings of Mount Vesuvius, and the vibrations of an œolian harp. So you see upon a summer's morning the verdure of the fields glittering with dew drops as with oriental pearl;—and in the house of mourning you see drop after drop distilled by sorrow, rolling globule after globule down the cheek. Hence the poet, without indulging in mere fiction, has justly and beautifully said:—

> "That very law which moulds a tear,
> And bids it trickle from its source,
> That law preserves the earth a sphere,
> And guides the planets in their course."

"Man is fearfully, wonderfully made," says a divine philosopher of old. But the hand of the same Great Artist is seen in the plants we eat and trample upon. Like us, they resist putrefaction while they live. Like us they maintain their temperature—like us, they may be said to eat and drink—like us, they have a vascular system carrying on an active circulation—like us they breathe. Like us they propagate. Like us they sleep. Like us they shed their usefulness about them. Like us they die.

It is the immortal part of man which alone exalts him above the tree that shades him.

When we thus behold the vegetable kingdom, equally as our own, imbued with the same characteristic properties of life, all contributing to the beauty of creation, and ministering to the wants and luxuries of all sentient beings; when we see in their system of vessels a living laboratory, not only for their own sustenance, but to yield some incense to nature, or some grateful food for our hunger, or some kindly balm for our disease; when we find in every leaf a respiratory apparatus, which, while it refines the juices of the plant, serves a more elevated purpose by purifying the atmosphere by night, and freshening it with vital air by day; when we behold these busy flowers blessed with their repose by night and awakening with expanded petals, painted with all the beauty of living colours, to the morning light; when we see them one hour, assiduously engaged in their appointed work, under the stimulus of a summer's sun, and the next hour quenching their thirst by drinking in with invigorating refreshment the balmy dew drops as they fall from heaven;—we become the better able to feel, and appreciate and admire, the force and beauty of the divine appeal to the moral evidence afforded by the vegetable world, "Lo, the lilies of the field, how they grow; they toil not, neither do they spin; yet Solomon in all his glory, was not arrayed like one of these."

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