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INTRODUCTORY LECTURE,* DELIVERED AT THE LIVERPOOL ROYAL INSTITUTION,

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GENTLEMEN,—In commencing the present session, I would beg those who are about to enter upon their studies, not to be alarmed at the long catalogue of subjects which constitute a course of medical education. In consequence of the authorised regulations defining the order in which those studies are to be entered upon, and the period over which they are to be extended, sufficient time, with ordinary industry and perseverance, is afforded for gaining a knowledge of them, sufficient to enable the student to become a candidate for practice. The *end* which the different courses of lectures have in view, is that most noble one, the relief of our fellow-creatures, under every form of disease or accident to which the human frame is liable. This important *end* is only to be attained by *means*, which require the united labours of many, the division of labour being no less beneficial in a course of medical instruction, than it is in the mechanical arts. Thus, in the departments of chemistry, botany, and *materia medica*, are explained the nature and properties of the materials derived from the mineral, vegetable, and animal kingdoms, of which we avail ourselves for medical purposes, in alleviating or curing alterations of function or structure. Anatomy and physiology explain the structure and functions of the body; the former is the science of organism, the latter the science of life. Pathology points out, not only the changes which take place in the body in consequence of disease, but the alterations of function by which those diseases are manifested. Anatomy, therefore, is the knowledge of the structure of the body in a state of health; morbid anatomy, the knowledge of the changes produced in that structure by disease. Physiology is the knowledge of the functions in a state of health. Pathology the same knowledge applied to disease. In the departments of surgery, medicine, and obstetrics, the practical adaptation, application, and combination of the knowledge derived from the previous studies, are developed and explained, and it is from their connexion with these departments, that the foregoing studies derive their principal value.

It has been often remarked, “that the proper

* This introductory discourse, which was not composed with a view to publication, has been forwarded to us at the request of several members of the Liverpool School. Mr. Long desires to express the obligations which he is under to the late Dr. Fletcher, Dr. Carpenter of Bristol, Dr. Conolly, the late Mr. Bennett, Hecard, and Mr. Quain, from whose writings he has freely borrowed.

study of mankind is man;” it is a study in which several classes of persons engage, each with special views. Some study his mental powers, or moral character, whilst others investigate his physical composition, and all the varied movements which it manifests during life, in order that they may be able to correct or remove those errors of action or composition, or, in other words, those diseases which from time to time occur, and so mitigate some of the evils “that flesh is heir to.” This is our object, and it is with this view that we enter upon those studies which are here to engage our attention. That the human fabric is “fearfully and wonderfully made,” “that it was the last of the Creator’s works,” “the beauty of the world,” “the paragon of animals,” are some of the expressions which the contemplation of *man* has at different times called forth. How the contemplation of this and the other works of the Creator, and of the admirable order which everywhere pervades them, should ever have the effect of rendering men Atheists, or of causing them to call in question the existence, power, or wisdom of the Creator, is as inconceivable as that the study of a beautiful and apposite piece of machinery should lead to the denial of the existence of the mechanic. The study of the works of nature, the wondrous adaptation of means to ends, of structure to function, furnish such incontestable evidence of design and contrivance, that a well-regulated mind must ascend at once to the contemplation of a designer, and “soar from nature up to nature’s God.”

It was remarked by the sublime Plato, “that the world is God’s epistle to mankind;” and Cicero, in his work *de Naturâ Deorum*, dwells more on the fabric and functions of the human body, than upon anything else, when he wishes to prove the existence of a supreme Cause; Seneca and Pliny were almost as much preachers as philosophers, and Galen’s work *de usu partium* may be regarded almost as a prose hymn to the Creator of the universe. It is lamentable to contrast the sentiments of these Pagan philosophers with some of those of the so-called philosophers of the present day, who, with all the advantages of more extended observations, have either been led astray into the path of uncertainty and doubt, or have stopped on the threshold of inquiry, and have let in only light enough to render darkness visible.

Those who are just entering upon, as well as those who are proceeding with, their studies, will do well to be upon their guard against some of the subtle theories upon which they may chance to stumble, and to receive with caution those theories which attempt to explain everything; there are many things which are essentially above our reach, and when we cannot exalt our capacities to the comprehension of them, it is better to say so, than endeavour to bring them down to the level of our capacities. When the student sees a being similar to himself, decomposing before him, he may conclude,

from this very fact, that the thinking principle still continues to exist, for what is termed decay is only another name for continued existence, it is nothing more than a change of the arrangement of the constituent elements; the strictest principles of chemistry demonstrating that not one particle of these elements ceases to exist. To conceive that anything mental ceases to exist after the death, when we know that everything corporeal continues to exist, is contrary to every rule of philosophical inquiry, and in direct opposition to the analogy which is furnished by the dissolution of the bodily frame. The facts which the observation of living beings brings under our notice, are, as has been already stated, of two kinds, the one having relation to their structure, the other to their actions; the difficulties in the observation of the structure are as nothing compared with those which beset the path of the physiological inquirer; the difficulty of physiological investigations results from the complexity of the combinations in which vital phenomena present themselves, and from their dependence on one another, to a degree which almost precludes their separate examination. It may be truly said, that the individuality of a mineral resides in each molecule, of a plant or inferior animal in each member, that of man and the higher orders of animals in the sum of all the organs; so that diffusion of the several organs is the characteristic of the lowest forms of organized beings; a tendency to concentration or centralization that of the higher, and this is in general in direct ratio in each, of the advancement of its organism, or of its rank in the scale of organized beings.

The means which nature employs, and the materials with which she works, are few and simple; it is from the different combination of these that such varied results are produced; of the elementary constituents of living bodies it may be observed, that nothing is found in them which does not occur in the world around; the elementary matters to form the immediate principles, and these to form the solids and fluid, are combined in a manner which chemistry is unable to imitate, and it is this which constitutes organization: the elements of these principles still exist, but held together by a property peculiar to living matter, and different from common chemical affinity. Chemical analysis is therefore useful; and useful it is, not in observing what such matter *was* composed of while living, but what it *is* composed of afterwards. It is necessary that the principles upon which animals subsist should be in a manner prepared for them: thus, the vegetable kingdom is a sort of laboratory, in which these principles are prepared for herbivorous animals, and these in their turn become a laboratory, in which these principles are prepared for the carnivorous tribes and for man.*

The fluids which enter into the composition of the body vastly exceed the solids; it is exceedingly difficult, if not impossible, to define the pro-

portion which the one bears to the other, in consequence of some proportion of the fluids always remaining; thus Milligan describes a mummy which weighed seven and a half pounds, as a "hydrate of humanity." The fluids may be briefly described as four—1st, the blood, which is the central mass of the circulating fluids; 2ndly, those fluids which are introduced into the blood from without; 3rdly, those which are taken up in the substance of the body, and are subsequently returned to the blood; and, lastly, those fluids which are secreted from the blood.

The solids are composed of tissues, all of which may be reduced to three, viz. the cellular, the muscular, and the nervous; from the various combinations and modifications of these primary tissues, all the complex machinery of the body is built up.

Thus, the cellular tissue forms, as it were, the groundwork of the body, in which all the other tissues are deposited—condensed externally it forms the skin, internally the internal skin, or mucous membrane; it forms the lining membranes of the cavities, the bones, ligaments, and vessels, envelopes all the organs, and enters into their intimate structure. The cellular tissue must be distinguished from the fat which is lodged in its interstices and contained in its own proper vesicles; this fat in children, owing to the activity of their external circulation, is principally accumulated externally, whilst in old age, in consequence of the languor of the external circulation, it recedes from the surface, and is accumulated internally; as the cellular tissue invests, lines, and connects the several parts of the body, so the fat fills up the interstices, and produces that polished outline which we see so beautifully developed in the female form.

As in certain parts of the vegetable organism we find the cavities filled with oil or gummy matter, stored up for the future nutrition of growing parts, so does it appear that the fat of animals is deposited in its vesicles, partly for a similar purpose. It is in a great measure from its absorption that we can explain the rapid wasting and sunken eye which take place in consumption, as well as the existence of those animals which pass the winter in a state of hybernation.

As the mucous membrane and skin are both modifications of the cellular tissue, so may the hair and nails be considered as appendages of the one, and the teeth as appendages of the other: a fact which seems to strengthen the analogy between the teeth and hairs, is, that whenever the teeth have been found in an unnatural situation, a mass of hair has generally been found to accompany, and often envelope them. In proportion as the cellular tissue is the most extensively diffused, so may it be considered as the lowest of all the tissues, and it decreases as the others become more and more developed. This holds good not only in the human frame, from its first formation up to its perfect maturity, but also applies to the whole animal and vegetable kingdoms.

The muscular tissue is peculiar to animals, and though its existence is probable, yet it cannot be proved in some of the lowest tribes; its distinctive character is that of contracting when irritated. One portion of this tissue is external, connected with the skeleton, and subservient principally to locomotion; these are the muscles of animal life.

* It has been remarked in a recent lecture by M. Dumas, "that from the aboriginal atmosphere of this globe three grand divisions have been formed—the present atmosphere, the vegetable kingdom, and animals; between these three masses a constant interchange of matter goes on. Matter descends from the air to vegetables, from the vegetable kingdom it passes to animals, and from the latter it ascends to the air whence it originally came. Thus, whatever the air yields to plants, plants yield up to animals, and animals finally restore to air—an eternal circle in which life revolves, but where matter merely changes place."—*Provincial Medical and Surgical Journal*.

Another portion is internal, unconnected with the skeleton, and connected for the most part with the mucous membranes; these are the muscles of organic or vegetative life. The former are under the control of the will, and are voluntary muscles; the latter are not, and are therefore involuntary, whilst those connected with the function of respiration are of an intermediate or mixed character. The nervous tissue, like the muscular, is also peculiar to animals; it has been detected by Ehrenberg even in the infusoria; like the muscular tissue, it consists of two portions, the cerebro-spinal presiding over the animal functions, and the ganglionic presiding over the organic functions, and an intermediate portion connected with the respiratory function.

It is an important fact, that the transformation of tissues is subject to certain laws. Thus cellular tissue may be evolved into any of the tissues which takes its origin from it; a new serous or synovial membrane may be formed, a new cutaneous covering to protect from the air, or cartilage to give elasticity; when a muscle is divided, it does not unite by the formation of new muscular fibre, but by an elastic tissue, which is the substitute for it in some animals, and merely a higher form of cellular tissue. Again, cartilage may become bone, but never mucous membrane; mucous membrane may become skin, but neither can become serous membrane. Moreover, all parts, when wasted or not sufficiently nourished, have a tendency to return to their primitive state, that of cellular tissue. In the reparation of parts, the effusion of coagulable lymph, or liquor sanguinis, is generally the first step, and this is subsequently converted into cellular tissue, whatever be the nature of the ulterior change it is to undergo. Having then seen how simple are the materials with which Nature works, we may notice, that according as she arranges these, so she forms those complex parts of the body termed organs, and as she associates these, so she forms the different apparatus. If the examination of the structure of the organs in a state of rest be interesting to the anatomist, how much more interesting must it be to the physiologist to examine them in a state of action, or of combined action, producing the functions of the body! When he examines those curious instruments, the organs of sense, by which we maintain our relations with the world around us—when he scrutinizes the functions of those inward parts which are more immediately connected with life, and the well-being of the individual, he recognizes each of these parts as instruments designed for special purposes, and in them traces the workings of causes in the production of effects, the adjustment of means conducive to ends.

The functions performed by organized beings are those which relate to the preservation of the individual, and those which relate to the preservation of the species. The first are those of nutrition, comprehending respiration, which effects necessary changes in the composition of the fluids. Circulation, including deposition and absorption, by which the fluids are propelled through the solid parts of the textures, form and deposit new solids and fluids, and break down and carry away the old ones. Assimilation, the reception of new solids and fluids, which are assimilated to the nature of the fluids so employed, for the purpose of renewing them in proportion as they become

wasted. The final result of these three actions is the maintenance of the individual, in its form, composition, and temperature. The nutritious fluid, then, is constantly renewed by absorption; is kept in a fit state by respiration and secretion; makes its way into all parts of the body by circulation, and there effects nutrition, a wonderful operation, in which it is decomposed in such a manner that in each part a portion of the fluid becomes solid, and forms part of an organ, while at the same time a portion of the organ becomes fluid, and enters into the mass of the circulation. In early life the act of composition predominates, in old age that of decomposition, whilst at the middle periods of life an equilibrium is established between the two. As by the act of nutrition the individual is constantly being regenerated, so by that of generation new individuals are formed, and the maintenance of the species provided for. In addition to those actions of organised beings in general, there are others commonly presumed to be proper to animals, and certainly requiring other conditions besides those which alone are necessary to the foregoing, viz. those by which they become conscious of impressions made upon them, or sensation—those by which, in virtue of this consciousness, they reason and will—or thought—and those by which, in virtue of this will, they effect various movements, or voluntary motion. The four first actions principally distinguish organized from inorganized beings; the three last chiefly distinguish some kinds of organized beings from others.

It is in examining into the functions performed by animals, that comparative anatomy comes to our aid, for it is almost impossible to investigate these creations, and the laws which govern them, without a sort of analysis; and this is afforded by the lower animals. In them, organism and its results are seen in their simplest form, and in a multitude of varieties, becoming more and more complex, until we arrive at the maximum of complexity—man. Cuvier has very appositely remarked, that the different classes of animals may be regarded “as so many kinds of experiments ready made by Nature, who adds to or deducts from each of them different parts, just as we might wish to do in our laboratories, showing us at the same time their various results.”

If we investigate the function of respiration, it will be found that whilst it is performed by the entire surface of the lowest tribes of animals, portions of this surface, specially modified, are found in the higher, being disposed according to the nature of the medium which the animal is destined to inhabit. Few persons would, at first sight, perceive any resemblance to the lungs of a quadruped, in the gills of a fish, in the elegant tufts on the body of the sand-worm, or in the air-tubes ramifying through the body of an insect; but this is easily understood, when we consider that to form the respiratory organ, all that is absolutely required is a membrane which shall be in contact with the air on one side, and with the circulating fluid on the other. All the forms of this organ possess this essential character, modified according to the condition of the structure at large, and becoming, like all the other organs, more special and concentrated as we proceed to trace it from the lowest to the highest animals. It is evident, at a glance, that the lungs of the higher animals

are composed of a series of vesicles, and it makes little difference, so far as their essential structure is concerned, whether there be only one such vesicle, or a countless multitude of them; the simple lungs of the frog are as much lungs as those of man, and the gills which it possesses in the tadpole state, may be rendered permanent by removing those influences which are necessary to its attaining a higher degree of development.

The key to the knowledge of the circulation is, that the blood is to be conveyed to all parts of the body, and that the crude aliment, as well as the blood which has already circulated, must be exposed to the influence of the atmosphere; hence the vascular system is modified for the attainment of these two ends. It is only in the capillary vessels, that is to say, in the minute ramifications which unite the arteries conveying the blood from the heart, with the veins returning it to that organ, that the blood acts upon the tissues of the body, and is subjected to the influence of the atmosphere, the larger trunks moving only to distribute it. In quite the lowest tribes of organized beings, it is not through proper vessels, but through the general spongy texture, that the fluids are moved, and it is in this that all the offices they perform are effected. A principal vessel next appears, a sort of aorta, in which the blood moves to and fro, as in worms. This vessel then dilates into a sort of sac or pouch, and this forms the circulating system of the arachnida and crustacea; this sac is then divided into two cavities by a transverse septum, the upper one the auricle, the lower one the ventricle, and this is the heart of fishes; a perpendicular septum is then formed, and by this each of the two cavities is to be subdivided into two; the septum between the ventricles is at first incomplete, as is found in the lower reptiles; that between the auricles is completed later, and remains imperfect in the amphibious animals; and lastly, we have the complete double heart of the higher animals, and of man.

The digestive apparatus, regarded in its simplest form, may be considered as a bag or sac, formed by an internal prolongation of the skin, and provided with an orifice, by which the nutritious particles are received, and by which the refuse matter is ejected; this form exists in the hydra: we there find it open at both ends, the nutritious matter being received at one extremity, and ejected at the other. The canal thus formed is not in the lower animals longer than their bodies, and is pretty nearly of the same diameter throughout. As we ascend the scale, it becomes more elongated and amplified, presenting those numerous divisions we find in man and the higher animals, being, however, somewhat modified according to the nature of the food on which the animal subsists. The liver and the other secreting organs connected with the intestinal canal are nothing more than extensions of its lining membrane; thus in the crustacea, the liver is composed of little pouches called *cœca*; these being extended and subdivided, connected together by cellular tissue, and having the minute terminations of the vessels ramifying upon them, constitute the organ in its most complex form, pouring its secretion into that cavity of which it is itself merely an extension.

We may now ask what are the lungs but a cell

or a concentrated congeries of cells; the blood-vessels and intestinal canal, but a string of such cells, between which communications (the original sites of which are still indicated by the rugæ, valves, &c.) have been established; and what is a heart or stomach but amplifications in certain places of these vessels or this canal?

With respect to that act by which the species is perpetuated, viz. generation, it will be sufficient to remark, that every living being is endowed with the faculty of reproduction, which is inseparably connected with organization, and that it is exercised in so diversified a manner as to have no character which is proper to, nor any which is common to, all animals.—Having taken this summary view of those actions which distinguish organized from inorganized bodies, we will now turn our attention to those which distinguish some kinds of organized beings from others; viz. sensation, thought, and voluntary motion; these give in some degree a new life to animals, and are, therefore, called animal or relative, whilst those previously described are the organic or vegetative; the latter are essential to life, and constitute *la véritable vie*, the former may be considered as adventitious or superadded to them; and though not essential to life, they modify considerably the organic, for in animals high in the scale of organization there is a reciprocal action of the vegetative functions, and of the principal organ of the animal functions; viz. of the circulation of nervous action, or of the action of the blood on the nervous system, and of the nervous system on the organ which moves the blood with respect to the movements. In the lowest and simplest animals, whatever degree of contractility be possessed appears to be equally diffused through the system, and we can neither discover in them any structure specially endowed with this property, nor anything resembling a nervous system to call it into action; in proportion as we ascend the scale, however, we find a distinct muscular system evolved, in which the general contractility of the body becomes as it were concentrated, and in proportion to its development and complexity it supersedes the corresponding but more feeble powers of the remainder of the tissues; it is now almost entirely subjected to the nervous system, those parts of it which are not connected with the functions of organic life being rendered subservient to the *will*, and thus becoming the instruments of its operation on the place and condition of the body. The contractility of a muscle is a property inherent in it; this is what Haller termed the *vis insita*; the stimulus to contraction is the will operating upon and calling this property into action.

A nervous system does not seem to exist in some of the lowest tribes of animals; in others it consists of a number of centres disseminated or scattered; and in the circumstance that all the parts, whether external or internal, whether belonging to the vegetative or to the animal functions, receive their nervous filaments from the same centres. In those animals in which there is no evident nervous system, or in which that system is destitute of a centre, the impressions are immediately followed by motion; in those in which the different ganglia of the nervous system are connected by cords, so as to form a centre, and in which there are particular organs of sensation, the impressions are received by the senses,

give rise to sensation, and the motions are determined by volition. It may, therefore, be presumed, that sensation is exercised by animals, only when their organism has attained a certain degree of development and advancement, and that as the rudest degrees of organism give rise to the faculty of irritability or vitality, so a more refined degree of organic structure than is possessed by any vegetable, and many animals, is also necessary to develop that of sensibility; this, in most animals, gives rise to the faculty of instinct, which, like an irresistible impulse, makes them produce, without instruction or imitation, very complicated actions, which are essential to their own preservation and that of the species.

As we ascend the scale of organized beings, we find the nervous centres become more and more developed, and, in proportion to their increased development, their functions become more and more complicated. The extent, diversity, energy, and complication of the intellectual operations, are, in general, in the direct ratio of the volume and multiplicity of the brain. In man, the brain arrives at its highest degree of organization, but the physical characters which this great development confers upon him, will never explain the vast disproportion which exists between his spiritual mind and the intelligence of the highest animals which approach the nearest to him in the perfection of their frame.

Mr. Hunter, by a happy turn of expression, described the functions of the nervous system as internuncial; thus an impression is made upon the senses, and is conveyed to the central organ producing sensation, and there gives rise to certain phenomena which may be comprised in the word thought. The idea that sensation is seated in the brain is a very ancient one; hence the axioms, "the mind hears," "the mind sees." In order to have a just idea of thought, says Cabanis, it is proper to consider "the brain as an organ specially adapted to produce it, in the same way as the stomach and intestines are adapted to produce digestion; the impressions derived from the senses, upon arriving at the brain, make it enter into action precisely as the aliments do with respect to the stomach, upon arriving at that organ;" and Dr. Barclay remarks, "that we may as well say that the arts and manufactures are derived from the doors and windows by which the raw materials enter, as that thought is derived from the senses alone; there must be something within to act upon these raw materials, and to construct out of them new fabrics, which are the result of the combined agency of the thing acting and the thing acted upon." All the more perfect animals, during the period of their formation, in all probability pass through a series of phases or changes corresponding to the permanent conditions of the lowest tribe of all, and that to which they are ultimately to belong: not only each organ, but the entire body passes from a fluid to a solid state; the solidification proceeds from the circumference to the centre, (and here is a distinct line of demarcation between organized and inorganized bodies, the latter having the progress of their formation from the centre to the circumference;) the proportion of the solids increases with time, and continues to increase to the end. There is at first no determinate texture in the organs; the cellular tissue and the vessels permeable to fluids diminish from the

commencement to the end of life; and it is this change especially which goes on after the period of growth has terminated, that appears essentially to constitute the period of the deterioration of the organism and of old age.

Thus, the human embryo, at first a mere zoophyte, passes through every possible gradation, in order to arrive at the perfection of man, so that, as Dr. Grant remarks, "we pass through the same stages of development, in tracing an organ through the highest animal in the course of its progressive elaboration, as by tracing it through the great body of the animal kingdom." Man, however, is distinguished from all animals by the rapidity with which he passes through the first stages of his formation. It appears, then, not improbable, that all tribes of living beings, with respect to their several organs, start as it were together, and that the germ of each of these organs is in all the same, and that they subsequently differ from each other, chiefly in arriving at their appointed goal sooner or later, those of the zoophyte, the zero of animal existence, reaching it almost instantly, others proceeding farther and farther, and man, the maximum of such existence, last of all.

It is to be recollected, however, that this applies to the organs individually, not to the fœtus collectively, for at no period of its development does an animal of a higher class resemble, in its totality, an animal of a lower: and though the organs of all are fundamentally the same, the human fœtus collectively is never formed upon any model but its own, and can never be mistaken for anything but what it is; the external form and shape are incomparably more rapid in assuming their proper characters, than any organ or portion of the system. The resemblance, then, not the identity of the human fœtus in its formation, to the lower animals, arises from the fact that the organs are not developed synchronously; one is developed more rapidly than another, and while one organ resembles its corresponding organ in one animal, a second will be analogous to that of another; though at one period the human fœtus has gills and a single heart, it still in other respects does not resemble a fish, and when the nervous system resembles that of a reptile, the heart may resemble that of a quadruped, and so on.

This law of development is not easily understood, in comparing an organ of an animal, high in the scale, with the corresponding organ of one very low in it; but it is undoubted, that however dissimilar, anatomically and physiologically, two given organs, when placed abruptly in juxtaposition, may seem, still that, by tracing them through all the intervening links, their structural elements will be found essentially the same.

The great Newton recognized the important fact of the unity of organic composition: when extending his views of the uniformity which he discovered in the planetary system, he remarked, "And the same may be said of that uniformity which exists in animal bodies." By uniformity of composition, then, is simply meant, that the materials which compose corresponding organs of animated beings are the same in all, and that the varieties these organs present are only modifications consequent upon their different degrees of development. Thus an organ in one animal will

perform actions to a certain extent; in a second it will perform these actions in a greater or less degree, in a third it will execute additional actions. The teeth in the stomach of a crab are essentially the same as those of the herbivora, carnivora, and of man. The ribs are developed to their maximum in the turtle, and form a case to protect the animal. The anterior extremity is in one animal used as a fin for swimming, or a wing for flying, in another for digging, for climbing, or simply for progression; whilst in man it becomes developed to its maximum as an organ of prehension and touch.

A beautiful illustration of the uniformity of composition, combined with that of progressive development, is, that we never find organs totally absent which are presented in a prominent degree by the members of adjacent groups, though to the animals possessing them in a rudimentary state they seem to be of no manner of use; thus the rudiments of the teeth, which are never developed, and at a later period cannot be detected, are found in the embryo of the whale, and during the development of the jaws of birds. Serpents have rudimentary legs; terrestrial animals, at a certain period, a branchial apparatus. In the abdominal muscles of mammalia, the white lines represent the abdominal sternum and ribs of lizards. The female of the marsupial animals has a bone which supports the abdominal pouch; and the male, though of course he has no pouch, has a similar bone; in the human subject the pyramidal muscles, the analogues of these bones, sometimes exist, but are as frequently absent; the existence of mammae in the male is an exemplification of the same uniformity of composition. These examples will be sufficient to illustrate the law, but it may be further observed that it is by no means unusual for an organ in one animal to serve, in the stages of its formation, a purpose quite different from that for which it is ultimately intended; of this we have an example in the swimming bladder of fishes. It is much to be regretted that this law of unity of composition has been distorted to the worst of purposes; it is not an idle or an useless speculation, but, taken in conjunction with that of progressive and excentric development, fraught with the most useful results; we are thus able to explain many vices of conformation and arrests of development, which without it would be otherwise inexplicable, they being only a permanent state in one or more organs of the steps or degrees through which these organs pass in their successive development. Before enumerating some of these, I may notice that Serres remarks, "that in malformations, animals never pass beyond the limits of their own class to take on that of a higher;" and Blumenbach remarks, "that he has often met with human monsters strongly resembling, in some of their organs, various kinds of brutes, owing to the *nisus formativus*, from some cause, not having reached the highest pitch of the human form, but having rested at a lower point; but had never once among brutes found an instance of monstrosity which bore any resemblance to the parts of the human body." It is evident that the organized world would soon present nothing but confusion and disorder, if laws fixed and immutable did not preside over the formation of living beings, and did not confine each in the limits which have been assigned to it. Sometimes the whole or a part of the abdominal muscles are

stopped in their progress forwards, and thus a space or vacuity is left in front, through which the bladder alone, or in conjunction with some of the other viscera, protrudes; sometimes the lateral halves of the arches of the vertebræ do not unite, and thus give rise to *spina bifida*; it is in this manner that all the natural tubes and foramina are formed; sometimes the æthmoid bone is not developed, and both eyes become fused into one, as in Cyclops. The intestinal tube is at first closed at both extremities; the lower extremity sometimes remains permanently closed, and this is no unusual malformation; it is almost unnecessary to allude to hare-lip, cleft palate, &c. With respect to the numerous malformations of the heart, and nearly all the varieties in the vessels, termed irregular distributions, they are referable to the same law, and have their prototypes in the permanent conditions of the lower animals. The same holds good with respect to the brain and nervous system in general; some monsters are born without a brain; in others, certain parts only are wanting; others, again, present a redundancy of brain, or certain parts are developed beyond the proper standard, at the expense of others which are deficient. As, however, the perfect state of an organ is the most frequent, it is more probable that its development will be arrested at a late period, when it is receiving its finishing touches, than at an earlier period, when its broader characteristics are being imposed; and such is found to be the case, trifling malformations being frequently met with, whilst those which strike the beholder with disgust are rare. We therefore see that order exists in the works of Nature, disorder in our manner of interpreting them, and that malformations are now proved to be merely the assumption of a condition as permanent, which ought only to have been temporary, and that what we consider to be a malformation in one animal, is found as the permanent and natural condition of the part or organ in another.

Having thus briefly surveyed the structure, functions, and development of the human body, I may remark that the functions are not exercised, or, in other words, the vital powers do not enter into action spontaneously, but through the agency of stimuli or excitatives, whether these stimuli act upon the external or internal surfaces of the body, or penetrate into its interior. An attempt has been made to identify electricity and galvanism with irritability and the nervous influence: they are analogous to the latter so far as they act as stimuli, and are a powerful means of promoting life or living action, but they are identical neither with the one nor the other. Organism and life, then, stand in the relation of cause and effect; thus, organism gives rise to the development of a certain property, called irritability or vitality; this, when acted upon by certain stimuli, produces those actions in the sum of which life consists. Dr. Mason Good, not inaptly, though in ridicule of this doctrine, compared the human frame to a barrel-organ, "possessing a systematic arrangement of parts, played upon by peculiar powers, and executing particular pieces and purposes; and life as the music produced by the general assemblage or result of the harmonious action."

As the functions do not enter into action *spontaneously*, neither are they called into action *simultaneously* in the fœtus. We have first only an absorption, and an almost imme-

diate assimilation of nutritive matter; then vessels form, and the circulation carries the materials of nutrition to all the parts of the body; the secretions then take place. At the period of birth, digestion and respiration are added, and lastly, the animal functions are called into exercise; neither is the action of any organ isolated, those which are centres exerting an influence upon all those which are subordinate to them; there is not a single organ which, on being excited in an extraordinary manner, does not exercise a greater or less influence on the entire organism. According to this view, the susceptibility of the organism to be acted upon, when natural, may be regarded as the predisposing cause, and the stimuli, when natural, as the exciting causes of those actions constituting health; and a derangement in the susceptibility becomes a predisposing cause, and a change in the stimuli, or exciting causes, produce an effect upon the health which is termed disease. Disease, then, consists in the derangement of the organism and of the natural phenomena of life; hence the utility of studying the circumstances and agents which act in a useful or injurious manner upon the animal organism; and the art of preserving and restoring health by the well-directed use of external influences, or the science of medicine,

If the above view of life be correct, it necessarily follows that death may ensue, either from a failure of irritability, which is irrecoverable, or from a failure of the stimuli, which may be restored. Thus, death may be permanent or temporary, producing what is ordinarily termed suspended animation, in which, though there is no manifestation of life,* there still remains a susceptibility of it; sometimes death is only partial, as in gangrene; sometimes such a sudden and total exhaustion of this irritability takes place, as by electricity, certain poisons, &c., that the blood does not coagulate after death, neither do the muscles become rigid, nor do they contract under the strongest of known stimuli, such as galvanism, which can arise only from a sudden failure of that property, which, under the ordinary circumstances of death, is only very gradually abstracted from them.

Such, gentlemen, are the observations which I have thought proper to bring before you on the present occasion; imperfect and superficial though they be, I hope they will prove sufficient to stimulate those who are entering upon the medical profession, to pursue their studies with ardour; they have an extended field before them, the cultivation of which will amply repay them. It is the lot of few to arrive at eminence, but all may, by a proper use of the abilities with which they are endowed, arrive at a certain point, and thus preserve the intellectual chain as unbroken as that of the animal creation. I would beg the student to proceed with order and regularity in his studies, and not to be led off from one subject to another, made more inviting by its novelty, for this has caused many to regret the dissipation of great abilities in a boundless multiplicity of pursuits, and to lament the inaccuracies and deficiencies of their acquirements, by aiming at too much. We must recollect that we are endowed with mental and corporeal energies, and that our imaginations can conceive more than our minds or bodies can execute; we must no more gratify our minds with schemes

which our lives will fail in attempting to execute, than indulge our corporeal appetites with pleasures which impair our intellectual vigour. The uncertainty of our duration ought at once to set bounds to our designs, and add incitements to our industry; and when we find ourselves inclined either to immensity in our designs, or to sluggishness in our endeavours, we may either check or animate ourselves by recollecting, with the Father of Physic, "that art is long, and life short."

REPORT ON MIDWIFERY IN PRIVATE PRACTICE.

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IN the seventh volume of the Transactions of the Provincial Medical and Surgical Association is an interesting report on Midwifery, in private practice, by Mr. Rose of Swaffham, in which, after stating the result of his experience, he expresses a desire that others would furnish similar reports, or supply monographs of their private experience, as means of affording data, in conjunction with those from public institutions, for a more correct estimate of the value of female life; and also of imparting useful information to the junior members of the profession.

There can be little doubt that the science of midwifery ought to occupy a considerable portion of the attention of general practitioners, and particularly of those who are situated in rural districts; where frequently, in cases of emergency, the assistance of a professional friend cannot be procured without a delay that might prove fatal, and where, consequently, the medical attendant is obliged to rely upon his own resources, and is solely responsible for the safety of his patient. It is no argument to the contrary, to advance that a large majority of labours terminate perfectly well under unskilful hands; for, in proportion to the ease with which the many are conducted, so are the few attended with the greatest difficulties; and I cannot conceive a position requiring more self-possession, more knowledge of the subject, and skill in applying it, or more kind consideration for the welfare of the suffering patient, than that in which a surgeon is placed when called to the management of some of the worst cases occurring in this branch of the profession.

From March 25, 1835, to March 31, 1839, the number of cases was 570, of which 253 were attended by my late partner, Mr. Taylor: and I regret that no register was kept of the latter, further than the names, dates of delivery, and results. Of the 317 cases attended by myself, there were 301 natural presentations, including thirteen with face to the pubes; and sixteen preternatural, viz. *three footling, six breech, one arm, three foot and funis, one breech and foot, one face, and one placenta.*

Sixteen children were stillborn; of these, *three* were premature births; *one* followed a case of placenta prævia; *one* a breech and foot presentation; *one* an arm presentation; *two* occurred in presentations of the funis and foot; *one* in a footling case, a first pregnancy in an elderly woman, where the soft parts were rigid and unyielding, and the labour very difficult; *one* from imperfect nutrition