Reading Room – Royal College of Surgeons 9.

9 from the Author

A

LECTURE

INTRODUCTORY TO THE

COURSE OF ANATOMY

AND PHYSIOLOGY,

DELIVERED IN THE

MEDICAL SCHOOL, ALDERSGATE STREET, LONDON,

UPON THE

OPENING OF THE SESSION—1832,

BY ROBERT B. TODD, M.A.,

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LONDON:

ADLARD, PRINTERS, BARTHOLOMEW CLOSE.

1832.

A LECTURE,

&c. &c.

GENTLEMEN,

There is no part of the Course of Lectures which it is my duty to deliver from this place, upon which I enter with more reluctance and more diffidence, than the Introductory Lecture. Lectures of this kind are generally considered as matters of form; too often are they taken advantage of by the Lecturer for the discussion of some favorite disputed topic, or some point of medical politics, subjects remotely connected with the objects of his course. It must be confessed that the Teacher experiences some difficulty in adapting his discourse to his auditors: the object which he should naturally have in view in a lecture of this kind, would be to give a clear and precise view of the field which is occupied by the science he proposes to teach; the uses and applications of that science; the most accurate and simple method of acquiring a knowledge of it; and the extent to which it is requisite that the student should pursue his researches. Now if we remember that, upon such occasions as the present, the audience is generally of a mixed nature, and that those things, which to novices are useful and instructive, may be tedious and devoid of interest to those more advanced in scientific pursuits, we shall see ample cause for embarrassment. But as I conceive my concern to be more especially with beginners in the science, it is my purpose to employ the time allotted for this lecture in adverting (as fully as my limits will permit,) to the particulars already mentioned; and I trust that the observations I am about to offer will not be found wholly unworthy the notice of the more advanced student.

When we wish to engage the attention of an individual in pursuit of a particular branch of study, we shall hardly attain our object, except we represent to him some inducement to enter upon the field of inquiry. We must prove to him that the science in question affords matter of great interest; and that a familiar acquaintance with its details must tend to personal gratification, as well as advantage: if we succeed in producing a conviction of the truth of these circumstances, we shall have gone far towards exciting him to enter upon the study. It is my chief object in this Introductory Address to animate my pupils with zeal and ardour in the pursuit of those fundamental branches of Medicine, Anatomy, and Physiology; and I know not that I can do this more effectually, than by setting before them the number and interest of the various topics connected with these sciences, and the great utility derivable from an accurate acquaintance with them, whether we regard them merely in the abstract, or as more directly bearing upon Practical Medicine.

Anatomy, in a general sense, is the science of living organization; it unfolds the intimate structure and composition of those several organisms with which life is united; and it explains the mechanism of the various functions which are essential to the continuance of life, in all stages of existence, from the simplest vegetable, to the most highly organized animal. The sphere then of the Anatomist, according to this general definition, is limited by the connexions of life. All living bodies are the objects of his research; the animal and vegetable kingdoms constitute the field in which he may roam. I have deemed it right to lay before you this extended sense of the term Anatomy, because I am persuaded that the close connexion between the two kingdoms, the many similarities which are to be found in them, the discrepancies which effectually separate them, and the scale of existence which their union exhibits, cannot be too strongly impressed upon the mind of the student. Vegetable Anatomy falls within the province of the Botanist; it enables him to discern the ultimate arrangement of the Vegetable molecules; it is his chief auxiliary in his attempt to establish the identity of particular plants; and to it alone is he indebted for those deductions whereby he is led to arrange them according to their several families.

All the individuals composing the great chain of beings, animals and vegetables, however they may differ from each other, possess certain characteristics in common. These characters are such as regard their origin, growth, and composition. We find that all originate from beings similar to themselves; all grow by the appropriation of foreign molecules or particles, and by the assimilation of those particles to their own substance; all likewise are made up of certain parts, each part performing a particular and distinct office in the economy. These parts have been named *organs*, and the being itself an organized being.

But there are other qualities common to all organized bodies; they are all endowed with a certain quantum of heat, each possessing its particular quantity, varying according to the position which it holds in the scale of existence. All these bodies resist the laws which govern brute or inorganic matter; and their state of composition is to be attributed to the operation of other laws than those of Chemistry, although, strange to say, there have been found men weak and silly enough to ascribe animal organization to the action of chemical laws. All beings, moreover, have a certain period of duration allotted to them, after which they cease to exist, disorganization takes place, and, in obedience to the laws of chemical affinities, they are resolved into their primitive elements. And we may here observe, that it is this rapid influence of the chemical laws upon dead organized matter which serves to distinguish it from inorganic matter which never lived.

I must not omit to notice the power inherent in all organized beings of regenerating mutilated or completely separated parts, a power which in some, as we shall presently see, is astonishingly great. This wonderful disposition in the organized creation ensures the preservation of plants and animals in the many accidents to which they are liable; it, together with the power of nutrition, forms a decided evidence of the superiority of the machines constructed by the Creator over the most perfect productions of human art, to which it is impossible to impart the power of remedying the defects arising from the disturbance, injury, or usage, of the parts entering into their composition.

Such, then, are the common properties of organized beings. We come now to advert to those discrepancies upon which their division into Animals and Vegetables is founded.

To the superficial observer, it would seem a matter of no difficulty to define an animal: accustomed to think of them as they appear in the more complex classes, those which most frequently are presented to our observation, he sees in the voluntary motions, the number and complexity of functions, and the instinct which guides the creature in his actions, characters sufficient to prevent the possibility of confusion; but if we direct his attention to one of the most simple individuals in the series of animals, he is compelled to admit that a closer scrutiny is requisite to determine to what kingdom to allot the individual. The case which I have supposed is not an imagined one; the history of the progress of Zoology informs us of the difficulty experienced by the earlier naturalists in deciding upon the animality of several of the most simple animals. It is well known that the celebrated botanist, Tournefort, formed nine genera of his 17th family of plants from polypes, known to himself and others his contemporaries; and Trembley devoted much time and performed many experiments to decide whether the Water Hydra was an animal or a vegetable. More accurate and careful examinations soon led naturalists to discover the fraud thus committed on the animal kingdom; and the corals and sponges, so universally considered as marine plants, were proved to be the productions of myriads of animals exhibiting in their structure the most simple grade of animal existence; and when Trembley saw the little Hydra, without bone or muscle, protrude its tentacula, move from leaf to leaf, and from stone to stone; when it displayed a decided predilection for the light, by abandoning the dark side of the vessel in which it was kept; when he saw it obviously influenced by the warmth of the sunbeam, and rendered torpid by the cold of winter, he had sufficient reason to induce him at least to doubt its merely vegetable nature; but when he saw it retreat upon being touched, defend itself when attacked, pursue its prey with avidity, and without tongue, teeth, or palate, devour as if with relish, and force the smaller animals of its kind into its pouch or stomach, he could no longer admit the claims of the botanist, where there existed so strong evidence of a more exalted vitality.

The celebrated Linnæus conceived that the possession of sensibility sufficiently characterised the animal, and he accordingly framed his aphorism, "*vegetabilia vivunt et crescunt,*" "*animalia vivunt crescunt et sentiunt.*" The truth of this aphorism cannot be questioned, animals undoubtedly possess sensibility, that is to say, the greater part of them do; but it is very doubtful that those animals in which no traces of nerves can be discovered, present any decided traces of sensibility. Had Linnæus drawn a proper line of distinction between irritability and sensibility, he would have formed a more correct idea of the true peculiarity of the animal fibre. For the existence of sensibility there is required the presence of a particular system of organs adapted for the production of this phenomenon, these organs we call nerves; for the existence of irritability, no particular organ is required, no distinct organ can communicate this faculty; it seems to be an inherent property, connected with the chemical composition of the parts during life, so that they contract upon themselves when subjected to an irritating cause. But it will be said, surely this property is to be found in some individuals of the vegetable kingdom; on what other principle can we account for the effect produced by external impressions on the *Mimosa Pudica*, improperly called, sensitive plant; or what but irritability could cause the sudden closing of the lobular bodies at the extremity of the leaves of the *Dionæa Muscipula*, should even a gnat light upon one of the glandular organs which are attached to them? Again, is it not in obedience to the stimulus of the sun's rays, that the *Helianthus or Sunflower* has its blossom always directed towards the sun? Time would fail me, were I to enter upon a refutation of this objection: it will suffice to state, that the phenomena attributed to the so called sensibility or irritability of plants, are the necessary effects of mechanical causes, or dependent on a power, in many respects, dissimilar to animal irritability.* If we then modify the Linnæan aphorism, and while we assign to plants the properties of life and growth, give to animals those of life, growth, and irritability, we shall have a more precise line of demarcation between the two classes of beings.

In addition to irritability, animals have certain essential characters serving still more to distingish them from vegetables. They are the only living bodies capable of action and of moving themselves from one place to another; their motions take place frequently without any cognizable cause; they introduce their food into their bodîes of themselves, and it is one of their functions to assimilate portions of it, rejecting those parts which are not adapted for nutrition. The contrast with vegetables is sufficiently obvious; fixed to the soil by their roots, they draw from thence their nutritious fluids which require no elaboration within them; they, therefore, do not require and do not possess the power of locomotion, nor have they any internal principle to stimulate them to action.

Many atttempts have been made to account for the phenomena of living beings, but what more can be said upon the subject than that they are phenomena only co-existent with life. Of the essence of life we are utterly ignorant; we know it only *as the connecting bond which unites and keeps in action a certain assemblage of functions in an organized body.* I would strenuously caution you against the danger of forming

* Those who desire to investigate this subject further, I refer to Lamarck's Histoire Naturelle des Animaux sans Vertebres, tom. i. Introduction.

any speculations upon the intimate nature or essence of life, or as to its source or origin. On no other subject have there been more absurd and groundless theories formed, volumes have been written in support of particular hypotheses; but no hypothesis is sufficient to account satisfactorily for all that is in connexion with life, but that which ascribes its origin to the voice of Omnipotence, and its continuance and preservation to the constant operation of the same Almighty Power.

It appears to me that the influence of life on organized bodies in enabling them to resist the action of the laws, which govern inorganic matter, suggests a by no means inapt comparison with the forces which are constantly in operation in our solar system. A series of orbs are maintained in constant revolution round a common centre—the sun,—each observes his proper distance and one undeviating path. To the unceasing action, and nicely-balanced adjustment of two mighty and ever struggling and opposing forces, are we indebted for the regularity of movement of our planetary system. One force attracts with considerable power all the planets towards the sun, it is the centripetal force; the other precisely proportioned to that attraction, is the centrifugal force, or projectile impulsion; always sufficient to prevent the solar attraction from pulling any one out of its appointed orbit down to the absorbing centre. Did either energy master the other, universal destruction must ensue; and yet such a powerful and vigilant superintendance is constantly governing both, that this perilous contest has continued for nearly 6,000 years without the balance varying in the slightest degree.

So, it appears to me, is it with the living body; two counteracting and opposing forces are continually in operation, the one, that which acts on all brute matter and which communicates to bodies the affinities they possess for each other; the second, that power which we denominate life—a perfect equilibrium is maintained, but no sooner does one master the other than confusion, disorder, and destruction ensue.

The striking example by which Cuvier contrasts the presence and absence of life cannot be too often repeated.*

Picture to yourselves, he says, a female, in all the vigour of youth, and "all the might and majesty of loveliness" —nameless charms shine around her—

> The light of love, the purity of grace
> The mind, the music breathing from her face;
> The heart whose softness harmonized the whole.

In a moment without apparent cause, she ceases to breathe, all power of motion has vanished, and now contrast what follows, with that upon which, but a few moments since, we gazed with admiration and delight. The cold and senseless mass is no longer affected by surrounding objects; the beautiful regularity and symmetry of form begins to alter; the relaxed and flaccid muscles allow the bones to project from beneath; the eye "that fires not, wins not, weeps not now," becomes glassy, flaccid, opaque. But these are only the precursors of changes still more horrible and disgusting, the flesh becomes blue, green, or black, it attracts moisture in considerable quantity, and while one portion evaporates into fœtid and putrid emanations, another flows into a putrid sanies, which soon likewise dissipates; in a word, at the expiration of a few days, there remain only a few earthy and saline principles, the other elements having been dispersed into the air or waters to enter into new combinations. With these changes the Anatomist is and must be familiar, his acquaintance with them will confirm the fact, while we trust it will not make him the less sensible of the solemn lesson they are calculated to impart.

It is thus then that we would describe life; to define it, is impossible—it is only to be known by its effects. Let it ever be remembered, however, that we have the highest authority for the statement that the possession of a rational and immortal soul is Man's peculiar prerogative, the cause and source of those powers of mind and reason which enable him

* Cuvier, Leçons d'Anatomie Comparée, tom. i.

to preserve that lordship of the creation assigned him by his Maker.

In the table before you I have exhibited the Classification of the Animal Kingdom, according to the method of Cuvier, with a few modifications. You will observe, however, that I have inverted his scale; and instead of placing the class of animals to which man belongs, in that situation to which the complexity of their organization would appear to entitle them, I have allotted them a position at the bottom of the series. In tracing the various component parts of the chain of animal existence, it is undoubtedly the most clear and beautiful method to commence with the most simple,—it seems to be conformable with what we may fairly imagine to have been the mode of proceeding in the original constitution of the various organisms; and as this is the plan which I intend to adopt in laying before you a rapid sketch of the animal kingdom, I have thought it more intelligible to exhibit the scale in an inverted form.

"If," says Lamarck, "we traverse, from one extremity to the other, the series of known animals, arranged according to their natural relations, commencing with the most imperfect; and if we thus pass from class to class,—from the infusoria which commence the series, to the mammalia which terminate it, we shall find, in considering the state of organization of the different animals, incontestable proofs of a progressive composition of their different organisms, and of a proportionate growth in the number and eminence of their faculties." This statement of this distinguished Naturalist, is beautifully confirmed by observing the various gradations exhibited by the organ which confers the sense of hearing. The first trace of this organ which we meet with, is in animals whose general organization is very simple, in the crustacea; in these animals, for example, the common crab, it consists of merely a sac or oval vestibule formed by a thin membrane of a white colour, and filled with an aqueous fluid; into this sac an extremely fine auditory nerve penetrates and ramifies upon its walls.* This vestibule constitutes the essential part

* Blainville—Principes d'Anatomie Comparée, tom i. p. 568.

of the organ, it accordingly is found in all the succeeding classes, and whatever additions are made to it are for the purpose of giving a greater degree of perfection to the sense. In the cuttle-fish, which belongs to the class of mollusca, we meet with the first complication in this organ, consisting in the deposit of a calcareous mass or small bone, floating in the fluid, which fills the vestibule; intended, doubtless, for impressing upon the expansion of the auditory nerve the vibration from the water. In fishes, there are added to this vestibule three canals of a semicircular form, one horizontal, the other two vertical; and connected with the inferior and internal part of the vestibule another sac is added, which, in the more advanced animals, assumes a very complicated form. These parts form the type of what, in man, we call the *internal ear or labyrinth;* to these is added, externally, a third or outer cavity, which communicates with the atmosphere, called the *tympanum,* and the outer wall of which is formed by a membrane, admitting of various degrees of tension, and which is acted upon by the vibrations of the atmosphere; various additions are made to the interior of this apparatus already sufficiently complex, till it reaches that wonderful and exquisite degree of perfection which it exhibits in the human subject.

The first beings, in which we can discover those properties which entitle them to the rank of animals, present a structure of great simplicity. They appear to be merely minute globules of semitransparent animal matter, or, as it has been well expressed, *mere living points.* They are of a gelatinous consistence, and assume various shapes; their minuteness is quite inconceivable, and the aid of a very powerful microscope is required to detect them in the fluid in which they exist; they have hence been called *microscopic animals.* No organ of any kind is to be found in them—no mouth, no stomach; and so frail and simple are their bodies that, accustomed as we are to view life in connexion with great complexity of organization, we find it difficult to comprehend how animal life can exist in them; yet of these animals naturalists have observed and described several tribes and individuals which, as it were, people the waters, and which are found in all the countries of the world, under certain circumstances. From the fact that these beings are invariably found in fluids, sea and fresh water, and the infusions of various animal and vegetable substances, they have been designated *infusory animalcules.* It is not, however, to be supposed that all infusory animalcules are of such extreme simplicity of organization; many of them are much more complicated, some possessing an outer shell, others provided with tentacula or arms, and others exhibiting a regular apparatus of stomach and intestines. On the minute structure of these animalcules the recent observations of Ehrenberg have thrown much light. It is, however, as the inhabitants of infusions that we meet those simplest forms of existence with which we commence the scale: the volvox and the monas are those to which I more especially allude, and with which every microscopic observer is familiar.

The earliest animals have received from zoologists the appellation *zoophyte,* signifying animal-plant; a name applied to them in consequence of an imaginary, gradual, or almost insensible transition from plant to animal. The term *protozoa* adopted by Goldfuss would be more scientific, as involving no theory. This genus, you observe, heads the scale which I have constructed.

The first complication which is made in these simple animal points, as they have been called, consists in the addition to the exterior of the animal of delicate processes extending from its body; some of which are so minute as to present the appearance of hairs; others are longer and more distinct in character, and resemble, on a very small scale, the feelers and tentacula of the more advanced animals. But the most important addition or alteration is that which has taken place in the interior of the animal. It can no longer be described as a solid globule of animal matter; its body now begins to be hollowed out, and soon a regular cavity is formed in it, so that it would appear to be little more than a stomach provided with arms for taking its prey. Such is the general description of a class of animals with which every one is familiar by name, I mean the polypes; they are defined by Lamarck as gelatinous animals with elongated contractile body, having no other internal viscus than a simple alimentary sac, open only at one extremity; they possess, therefore, a mouth only, by which they take in their food and reject the superfluous matter. This mouth is in many surrounded with moving ciliæ or tentacula, destined doubtless to enable the animal to seize its food. The infusory animals not having been provided with an alimentary sac must have obtained their nutrition by the absorbing power of their external surface; to these animals a second absorbing surface is added in their internal cavity, and they are thus enabled to afford nutrition to every living point. Some employ this fact to explain the impunity with which animals of this grade can endure mutilation. The separated portion, say they, continues to live after the manner of the Infusoria, and as it becomes further developed, it re-establishes the second absorbent surface which belongs to their nature. The mode of reproduction or regeneration of these animals is not the least curious of the circumstances connected with them. They are technically said to be *gemmiparous;* that is to say, their propagation takes place by the shooting out from the parent animal of gems or buds, varying in situation and number; in some these gems arise from the exterior of the animal and are uncovered; this is the case in the hydra, which has been better observed than perhaps any other polype; in another set they arise from the exterior, but are enclosed in vesicular sacs; and in a third they form in the interior of the animal, in the alimentary cavity,—either separate and susceptible of being rejected by the mouth, when they are loosed from their connexion with the body of the parent, or congregated together and enclosed in a distinct sac, and evacuated in that manner: the first indication, perhaps, of the viviparous and oviparous modes of generation.*

I have already alluded to the power possessed by animals of this kind, of regenerating separated or mutilated parts, and it may be stated as a general law, that this power is directly proportioned to the facility and simplicity of re-production. A single example will serve to illustrate this wonderful faculty. "If," says Blumenbach, "a hydra be divided into six or

* Lamarck Histoire des Animaux sans Vertebres, vol. i.

even more pieces, each piece will, within a few days, become converted into a perfect polype. By dividing the head or posterior part of the body longitudinally, the number of these parts may be increased at pleasure; several may be stuck together, and in this or other ways formed into monstrous groups: they may be turned inside out like a glove; a manœuvre, it is true, requiring considerable dexterity and practice: they may be divided longitudinally, and expanded like a piece of riband, and in that state, as Rösel has remarked, they have the power of destroying each other in an incomprehensible manner, or rather of running together; according to the remarkable observations of the late Professor Lichtenberg, when included in a noose of hair, in proportion as the loop cuts its way through them, the divided parts are re-united.*"

Many polypes adhere to one another either by lateral appendices, or by their posterior extremity. They communicate together by these means; digest in common the nutritive matter which any one may have procured; in a word, participate in a common life, while they each enjoy an independent life in every part of their bodies. They form those animals called *compound animals;* generally fixed to rocks, or to the bottom of the sea, they were, for that reason chiefly, long considered as marine plants. They are the first animals capable of forming for themselves fixed coverings, more or less solid, and hence it is that we always find them in connexion with those large and often stupendous masses of calcareous deposit, generally known under the name of *corals,* but better named by the French, *polypiers.* It is now indisputable that the great coral reefs, which sometimes afford a dangerous impediment to the mariner, by blocking up harbours or creeks, and projecting above the sea from an immense depth, are formed by these simple animals, in a manner analogous to that in which the snail secretes his shell. The rapidity with which they multiply is sufficient to account for the great numbers in which they exist, and the magnitude to which the corals arise.

The simplicity of structure which we have described in the first group of individuals among the zoophytes, does not per-

* Blumenbach's Natural History, by Gore, p. 274.

vade all the species of that genus, so early does the distinction of parts and organs begin to take place; we have not, therefore, to leave this class to observe new forms of organization. The individuals of the species *echinodermata* present these changes; no more do we see the simple gelatinous, uniform, and homogeneous body hollowed out into an alimentary bag; in the beings to which I allude we find a distinct alimentary canal, with its orifice of entrance and its orifice of exit—its mouth and its anus: this canal is lined by a membrane, the first appearance of an internal cutaneous system. The mode of reproduction of these animals, too, departs from primitive simplicity, and is carried on, not by the shooting of gems from the body, but by organs regularly set apart for that purpose, and termed ovaries; the fluids instead of being diffused, as it were, through the solid parts, are now contained in separate vessels or canals, and a degree of oscillatory motion is observed in them, exhibiting the first approach to a circulation; and many anatomists suppose, that even at so early a period, provision is made for subjecting the fluids to certain changes to adapt them the better for the purposes of nutrition, by the addition of separate organs for this function, which we denominate respiration. Some species of echini and asteriæ are provided with small projecting and contracting tubes which, it is not improbable, are intended for the performance of this function. Some observers have noticed and described the presence of nerves, or those organs which confer sensibility upon the animal; but on this subject we are as yet much in the dark, so minute are the objects of our research, and so imperfect our means of observation; but it is indisputable that three important processes can go on even in so simple animals; I mean those of digestion, circulation, and respiration.

Hitherto the animals we have examined, were either obedient to the motions of the media in which they moved, or were fixed to a particular spot unable to change their places; it is true they could unfix themselves, but they must trust to the element in which they lived to be wafted here or there; But now we notice the addition of a new structure, which in the more complex animals is brought to a high degree of perfection, to be the chief agent in their numerous and varied locomotive efforts. This is the muscular tissue, so remarkable for its great contractility. In these creatures it is deposited in scattered fibres beneath their external or cutaneous covering, and by its contractions gives them the power of altering the relations of the different portions of their own bodies with each other, as well as those of the entire body with space. For the further promotion of this power of locomotion, we find certain external complications which, together with those contrivances by which the animal is enabled to seize its prey or to adhere to solid substances, produce those differences of form and appearance which we employ as distinctive characters between the different individuals of the same species.

Leaving the zoophyte genus, we find the external conformation of the next series of animals to assume more of a determined form; and here we first remark that which anatomists denominate symmetry; a plane, dividing the animal longitudinally into two equal portions (in anatomical language, a median plane,) leaves on each side of it corresponding organs. We moreover find here the body of the animal divided into parts with greater precision than heretofore, and these parts are so connected with each other as to admit of the motion of one upon the other; they are said to be jointed or articulated together, and hence the individuals of this genus are congregated together under the general title *articulata.* But the mode of articulation here is very different from that whereby the limbs of the more perfect animals are connected with each other. Here are no internal hard parts which may act as a kind of frame upon which the soft may be applied. The hard parts of these animals are employed as a covering and protection to the delicate internal organs; a protection the more needed, as already has their regenerative power begun to diminish in proportion to their advance in organization. We have already seen that the secretion of a hard external covering (for that it is a secretion the experiments of Reaumur and others fully attest,) was performed by animals of great simplicity, in fact, by zoophytes, but not with the same degree of perfection. All of you are, doubtless, practically familiar with the testaceous covering of the crab and lobster, animals which belong to a species of the genus articulata, and there are few who have not had to admire the exquisite delicacy and variety of the outer coating of various individuals of the insect tribe, especially the *Coleoptera* or beetles, which of itself is sufficient to betoken a considerable advance in the organic powers of the animal. Here, too, we first remark, as among the more complex animals, the different varieties of progression, walking, flying, leaping, or swimming, and organs of course admirably adapted to these several purposes. It is, in fact, in this genus that we are most struck with what has been well called "the insatiable variety of nature;" whether we take into account the innumerable hosts of each of the species, the insects in particular, or the evident indications of design afforded by their organization.

The internal arrangement of these animals affords further signs of complication. The functions which we have already noticed in the zoophytes were there but in their infancy, and the organs for their performance, frail and rudimentary. In the articulata these processes assume a more obvious, and, if I may apply the term, tangible character: the organs for the performance of the respiratory functions are no longer dubious in their nature; the nutritive fluid is subjected to the action of air or water, either by being made to pass through a separate organ, with which the air is brought immediately in contact, or by means of lateral pores, the outer orifices of tubes or tracheæ which traverse the body of the animal. The circulation in some species is confined to a vessel placed along the back of the animal, and thence called a dorsal vessel; and in others we observe at one extremity of this vessel a dilatation or enlargement which seems to be endowed with contractile power beyond any other part of it; this is the first indication of a heart. The nervous system of these animals is sufficiently distinct; small masses of nervous matter being deposited in various parts of the animal's body, connected by chords from which branches pass off to the neighbouring parts. In the digestive organs, besides the increase of length, (i. e. of proportional length,) and of complication of the digestive tube, bodies termed glands make their first appearance; they are destined for the secretion of fluids which aid in the digestive process. A very important and new class of parts and functions are first met with among this genus; I mean those which, as immediately concerned in conferring the senses, are called *organs of sense.* Those of sight and hearing are undoubtedly found in these animals; to the simple conformation of one of which I have already had occasion to allude.

The next genus which we meet with as we descend in our scale is that of the molluscous animals, in which we find a considerable advance in each of the classes of organs already alluded to. Here we first find a true heart, differing from that of crustacea, in consisting of two portions or cavities,—one for the reception of the returned blood, the other for transmission.

It is among the Cephalopoda of the Mollusca that we first meet with a brain; and among them, too, we first find a cranium. A more perfect nervous system then characterises these animals, and they afford us the earliest traces of a skeleton. The series of animals which complete the scale exhibit the grand distinctive feature of the possession of an internal skeleton, a basis upon which the other parts may rest, and in which cavities may be formed for the protection of organs whose integrity is essential to the continuance of life; and here, too, we find a gradation well worthy of notice,—as well in structure, as in the number of parts. As regards the one, we see the transition from the soft and flexible cartilaginous skeleton of some fishes, to the hard osseous one of the mammalia; and in the other, we pass from the skeleton consisting of merely the head and vertebral column, with incomplete thorax, to the perfect skeleton of birds and mammalia, complete in its cavities and appendages.

Various changes and additions in organization are to be noticed as we pass successively through the classes of fishes, reptiles, and birds, to the most highly organised and most perfect class, the mammalia, which are distinguished from all the rest of the animal series by their mode of nourishing their young by teats or mammæ. A distinct post among these animals is allotted to man, whose erect posture and upright stature announce his superiority over all the other inhabitants of the globe.

> Pronaque cum spectent animalia cætera terram
> Os homini sublime dedit; cœlumque tueri
> Jussit; et erectos ad sidera tollere vultus.

With him we meet with the most perfect organization; in him organization has arrived at its acmé; it is the investigation of his exquisitely perfect structure and functions, or, in other words, Human Anatomy and Physiology, that are to occupy us in the ensuing lectures.

The anatomy of man is to be considered under three points of view: First, as it unfolds the minute structure and mechanical disposition of the different parts of the body; here our object is directed to discover the adaptation of organic structure to the performance of function, or of mechanism to the attainment of a certain end; just as one would take to pieces a complicated piece of workmanship, with a view to discover how it fulfils the design of its maker, and, moreover, analyze the minute arrangement and composition of the material of which it is made.

Secondly, we study anatomy with the highly important object of enabling us to expose any given part in the living subject; for this purpose we endeavour to ascertain by frequent dissections, with accuracy and minuteness, not merely the parts that are to be found in any particular region of the body, but the positions which these parts hold with respect to each other, and the remoteness from, or proximity to, the surface of each. This is what we denominate Relative or Surgical Anatomy; it is undoubtedly the most interesting way in which the surgical student can study anatomy, and, without question, he will never have cause to lament time devoted to the acquirement of an accurate knowledge of it; for when engaged in practice, he will find it constantly necessary to summon it to his aid.

The third point of view under which anatomy is to be studied by us, is as it represents those several structures with which we have made ourselves familiar in a state of health,—as it represents them, I say, as altered by the ravages of disease; and if Surgical Anatomy be an important branch of knowledge to the surgical student, a minute acquaintance with Pathological or Morbid Anatomy is not less essential to the student of medicine. A familiarity with its details, in reference to the changes they produce in function, and the symptoms which denote them in the living body, will go far towards rendering its possessor an able and scientific physician.

I have already observed that anatomy, in its relations to surgery, claims most the attention of the surgical student. I once heard an anecdote, bearing upon this subject, from a very eminent member of the profession, and one of the examiners of the College of Surgeons, which will, I think, prove to you more strikingly than any argument I can advance, the folly of neglecting Relative Anatomy.

A student came before him in his capacity of examiner at the college; the subject on which the young man was questioned, was relative to the several structures found in the arm; he enumerated them correctly and displayed a considerable knowledge of the various processes of the bones; the ligaments which unite the bones together; the muscles, their origins, insertions, and actions; the manner in which the limb was supplied with blood; the nerves which animated it with energy. The examiner had formed a high estimate of the youth's abilities and anatomical attainments, and was about to compliment him on his answering; but an unfortunate question as to the relative position of the artery, tendon, and nerve at the bend of the elbow, exposed the real nature of his knowledge, and deprived the poor student of the good opinion of one of the first surgeons in the world. It was soon found, that his ignorance of the relative anatomy of the several structures entering into the composition of the arm, was as great as the acquaintance he had just displayed with their names, attachments, and mere mechanical application. His knowledge was obtained by rote, and he substituted a close application to systematic authors for the diligent use of the scalpel, and examination of the dissected subject in the dissecting room. Such knowledge was of course badly calculated to render him a useful surgeon, or skilful operator.

I shall conclude this Lecture with a few suggestions to those who are about to commence their anatomical studies.

The chief art of learning, says Locke, is to attempt but little at a time; and if Locke had been an anatomist, he might have added a special clause in favor of anatomy. Most students err by attempting to grasp at too much, and they enter upon the more difficult parts of anatomy before they have acquired an accurate knowledge of the more simple and fundamental. The student should first make himself familiar with the frame-work of the body before he goes farther; he should know the bones well before he attempts to dissect the soft parts connected with them. When he comes to dissect, let him do but little at a time; *let your day's dissection,* I would say, *be confined only to so much as you can read about and think over when you return to your home:* you will find that a plan of this kind will, with infinitely less labour, make you much better and more accurate anatomists, than if you were to dissect subject after subject without giving yourselves time for reflection, or for consulting approved authors.

But it is from the rigid observance of a systematic regularity, that the student may expect to derive most advantage. Irregular attendance on Lectures is pretty similar in its effects to reading an extensive treatise on a particular subject only in detached parts, those which have been omitted being, for aught the reader may know, the most instructive portions of the work. I would recommend every young person, who desires to profit by what he hears and reads, to set apart a particular portion of each day, for meditation and study, with the fixed resolution to allow nothing to break in upon it; this rule observed, even for a very limited time, daily, cannot fail to be productive of the best results.

In conclusion, I have only to say that, so far as I am concerned, no exertion shall be wanting to render the ensuing Lectures as useful and instructive as possible, to those who may honour me with their attendance; and my most zealous efforts shall at all times be directed to promote the interest and advantage of my pupils.

CLASSIFICATION
OF
THE ANIMAL KINGDOM.

A. ZOOPHYTA.

1. Infusoria - -	vibrio,	monas.
2. Polypi - - -	hydra,	sponge, coralline.
3. Acalephæ - -	actinia,	medusa.
4. Entozoa - -	tænia,	hydatid.
5. Echinodermata,	starfish,	echinus.

B. ARTICULATA.

1. Annelides or Vermes.

a Tubicolæ - - -	serpula,	sabella.
b Dorsibranchiæ -	nereis,	aphrodite.
c Abranchiæ - - -	earthworm,	leech.

2. Insecta.

a Aptera - - - -	centipede,	podura.
b Coleoptera - -	beetle,	glowworm.
c Orthoptera - -	grasshopper,	locust.
d Hemiptera - - -	fire-fly,	aphis or plant-louse.
e Neuroptera - -	dragon-fly,	ephemera.
f Hymenoptera - -	bee,	wasp, ant.
g Lepidoptera - -	butterfly,	moth.
h Rhipiptera - -	xenos,	stylops.
i Diptera - - -	gnat,	house-fly.

3. Arachnida.

a Pulmonalia - -	spider,	scorpion.
b Trachealia - -	phalangium,	mite.

4. Crustacea.

a Decapoda - - -	crab,	lobster.
b Stomapoda - - -	squill.	
c Amphipoda - - -	gammarus.	
d Isopoda - - - -	asellus.	
e Branchiopoda - -	monoculus.	

C. MOLLUSCA.

1. Cirrhopoda -	barnacle.	
2. Brachiopoda -	lingula.	
3. Acephala - -	oyster,	muscle.
4. Gasteropoda -	slug,	snail.
5. Pteropoda - -	clio,	hyalæa.
6. Cephalopoda -	sepia,	nautilus.

D. VERTEBRATA.

1. Pisces.
2. Reptilia.
3. Aves.
4. Mammalia.

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