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THE FIRST COURSE

OF

LECTURES ON PHYSIOLOGY AND SURGERY,

DELIVERED AT ST. GEORGE'S HOSPITAL,

BY JOHN HUNTER, F.R.S.

(From the Manuscript of Dr. Thomas Shute.)

LECTURE I.

INTRODUCTION.

Matter and its properties; differences between animals and vegetables; life and its properties; the stomach; different kinds of action; the senses; life compared to magnetism; vegetable and animal substances; instincts; sensation; sympathies of the stomach.

GENTLEMEN,—The principles of surgery have not been hitherto so much attended to as they ought; operations have been most studied and improved; surgeons deriving more importance from the performance of capital operations than from their judgments. By-standers look at an operator with a degree of awe, as the executioner is beheld by the vulgar with greater awe than the judge.

Genius goes beyond routine, and catches at principles, and distinguishes a Columbus, Newton, &c. Columbus was the first genius in the world.

To have just ideas of any subject, it is proper to begin with its first principles, as far back as they are known, tracing the subject to its origin. In these lectures, therefore, matter is first generally considered, that being the first idea we obtain. By matter is here meant that general substance of which this earth is composed.

Every arrangement of matter is liable to accident. In mechanics, by force; in chemistry, changes are produced by attractions; but in animal bodies the powers of change are inherent in the matter.

It is by our sensations that we are acquainted with the properties of matter. And it is from the different properties of matter that we acquire a knowledge of our senses. Thus each makes us acquainted with the other.

As sensation alone makes us acquainted with matter, the properties of matter are demonstrated as far as we can demonstrate our sensations.

The matter of which this earth is composed may be the same in every part, and the variety of forms or kinds of matter which seem to exist, may be nothing more than the same, with its particles differently arranged.

From the different manner in which matter affects our senses, it has different names given to it.

There are some properties common to all matter, and others which belong only to different kinds, or modifications of matter. One of the first is the attraction of gravitation, by which the whole earth is kept together, and the animals upon it. A

second, the attraction of cohesion, by which the parts forming one substance are kept together. By this attraction various particles are frequently combined together, forming apparently one homogeneous mass. A third property is elective attraction, which occurs where particular particles attract those of another kind in preference to others, leaving those they were before combined with, and thus forming new combinations. A fourth property is that of repulsion; this is not perhaps a very general one, though evident enough in some instances.

Vegetables and animals have these properties, and another added to them, called the living principle. This particularly active principle given to matter, is commonly called life.

Mechanical properties depend on the figure of matter, but life is independent of all form.

Vegetables and animals differ from each other in this; a vegetable can be nourished, grow, and continue from a supply of common water only; whereas an animal can only live by being nourished with animal or vegetable substances, as far as we are at present acquainted.

Water would seem to be an intermediate step between common matter and vegetables, and vegetables an intermediate step between water and animals. Dung, which is a mixture of animal and vegetable matter, increases the growth of plants. It is not known how far it is convertible into vegetable matter. Some suppose that it acts only as a stimulus.

Vegetables and animals have a power of changing those substances, which are appropriated to their nourishment, into a similar substance with themselves; this is a property or power existing within them, and is owing to their living principle.

Vegetable and animal matter may be in two states, either living or dead.

Animal matter may be considered in three ways: its living powers, its chemical properties, and the manner of its reduction into common matter again, after having lost its life. The first of these prevents the two last from taking place.

When life is lost, the same modification of matter apparently exists as before, and if life consisted in such modification of matter, then it could not be lost until that was altered. Whether matter is alive or dead, we conceive it to be the same. For instance, the matter of which a muscle is composed we conceive to be the same, either when it possesses the living principle or not. Iron, when it has magnetism given to it, is not at all apparently changed, though it has a new property superadded: deprive it of this property, and it still continues iron the same as before. Magnetism may arise, perhaps, from a particular arrangement of the particles of iron.

Life also may arise from a particular arrangement of the most minute parts of animal matter. This may be illustrated by considering how glass is made. Glass is nothing but common earth, which receives its transparency from a particular

arrangement of its parts, and when such particular arrangement is altered, and the glass becomes opaque, it is still as much glass as before. Glass, then, is only a particular modification of matter.

Organization is not necessary to life, it is only necessary to perform some action. Life has the power of putting that organ in motion.

Matter may be alive when its arrangement does not admit of action; capability of action depends on the arrangement of living particles; on their being so disposed as to admit of it. One arrangement of living particles gives one species of action, another a different species. Muscles have a power of growing, contracting &c. Tendons have no action but that of preserving themselves, growing, &c.

The active parts of animal solids require a degree of cohesion in their particles, without which no determinate action could be performed. That construction of particles which is adapted to motion is found in muscles; and as there is no part free from motion, all parts growing, &c., the muscular structure must be very general.

The simplest idea of an animal is the conception of a muscle, for without motion no animal could exist.

Living parts have a power of forming themselves, which is contrary to every other principle we are acquainted with. It may be conceived that three particles of living matter, when in contact, may perform some action: that is, if they are spherical, they may form a triangle with an intermediate space; and that they may have a power of contracting—such contraction or approximation lessening the intermediate space, which may appropriate a fourth particle of matter to the other three by getting between them. In like manner a fifth and sixth particle may be added, until there are a sufficient number to form an organ. But an organ cannot be formed by four or five particles, therefore in such case life must exist before the organ. If this conjecture is right, organization is a consequence of life, and not life a consequence of organization.

The active principle with which animal matter is endowed, called life, is more complicated than all others; therefore the most difficult to understand.

The actions of animals are of two kinds:—1st, the actions of life; 2nd, the actions of the will, which are produced by external impressions.

The actions of the first kind are those by which the body preserves itself, repairs its waste, &c.; these are permanent and never intermix, except in disease. An instance of this kind lately happened to myself. One morning I was attacked with a faintness, and looking in the glass I saw myself pale like a corpse: my pulse stopped and breathing, so far as it is vital and involuntary: I continued respiration by voluntary actions, and after struggling with the death of the internal actions for a complete hour, (during which time there was no pulse nor involuntary respiration), I recovered.

Respiration is partly voluntary, for we can breathe faster or slower at pleasure; and it is partly involuntary, as breathing is performed instinctively.

The stomach is the seat and centre of involuntary actions; it being disordered, every other part is affected; and affections of most other parts affect it: a blow on the head produces vomiting, and a

blow on the stomach will often instantly kill; and the death is so complete that every part of the body becomes instantly motionless, every muscular fibre at once loses its power of contraction, nor can be roused by any stimulus. If the head was cut off, the heart would act for some time.

The stomach is not affected by such trifling causes as the brain, but is rather influenced by the economy of the machine than by external causes. Its strongest affection is the want of nourishment, being conscious of some defect in the animal economy: but it is also concerned for the diseases and distresses of the different parts of the body, some of which it sympathizes with in a very particular manner, as the testis; or such parts as are naturally possessed of little sensibility, as tendons, ligaments, &c., and also involuntary parts. But it is less mindful of the diseases of parts possessing great powers of life under the influence of the sensitive principle, as muscle, &c.

The second kind of action is voluntary motion; as progressive motion, catching food, &c.

Animal matter, as above described, has other powers superadded:—the peculiar actions of the brain and nerves: so that there are two principles of life.

Many animals have no brain. When a brain is added, the animal has sensation. Brain is the seat of sensation, and nerves produce the connexion between it and the involuntary organs.

Nerves have three powers; one a passive power, and the other two active. The passive power is that of receiving impressions, out of which arise the other two: 1st, the feelings of the mind; 2nd, volition. The will is reasoning about actions. The feelings of the mind are involuntary. Brutes are ruled by what may be called the feelings of the mind: for instance, a man who is challenged to fight; reason determining him to go to the place appointed, but when arrived, his joints tremble, his stomach turns sick, &c.; effects of the feeling of the mind: thus the feelings of the mind are not subject to the will, but affect at once voluntary parts, exciting involuntary actions.

The voluntary actions are subject to disease, as the palsy, St. Vitus's dance: these morbid states arise from the brain and mind, and are not observed to take place in sleep.

There are two senses, taste and touch, which seem to have appendages: sickness at the stomach is a sense which belongs to taste. The sensation in the glans penis is not touch, it arises from a peculiar structure of the nerves, and may be called an appendage to touch.

Itching and tickling are not simple sensations, but particular actions requiring particular modes of impression.

Matter, to perform any mechanical purposes, only requires form and solidity; but life is independent of these. Life has been compared to the spring of a watch; but this depends on a continuation of parts particularly arranged; whereas life exists in every part equally, and as much when separated from the rest as before.

Magnetism, may assist in giving an idea of life. Magnetism by being added to iron, gives it a power of motion; not properly of motion within itself, but a power of moving other bodies towards itself. This property then is superadded to iron, for iron is as perfectly such, whether it has magnetism or not. It is a property which may arise

from a particular arrangement of the particles on the surface of iron : or there may be such a principle in nature, which it is fitted to receive.

The actions of life are totally different from those of mechanics or chemistry. Mechanical action must at all times be the same, let it be performed by whatever matter ; the only difference that can arise is in the degree of solidity. Chemistry is the particular action of one kind of matter on another, which between any given two will be invariably the same. The actions of life differ from these in varying in such actions according to different circumstances. Many of the actions of an animal body may, however, be mechanical, but the principle of action cannot.

Matter undergoes gradual changes to become animalized, which appears to have been hitherto unsuspected. Animal matter being so different from others, apparently, in its properties, has been ranked apart from them, it being supposed totally different from all others. If, however, we take a view of its origin and gradual changes, it will not appear so totally different.

Water is converted by vegetables into vegetable matter, and vegetables are converted by animals into animal matter ; thus common matter undergoes its changes into animal matter.

Vegetation seems to arise entirely out of water ; Duhamel made an experiment which appears to prove it : he planted a vegetable in pure sand, and supplied it with distilled water ; when it had grown to a considerable size he took it out, and found the sand, on weighing it, was as heavy as at first. Water only appears to enter into the composition of vegetables ; but if water is scented, it will, in that state, be taken into vegetables, and taste of it ; this is a proof that it passes into vegetables ; but, then, it proves it does not enter into composition, for if it did, it could not be tasted. The nourishment of vegetables, however, seems to be increased by supplying them with animal and vegetable substances, as by manure.

The fermentation which takes place in animal and vegetable matter is that process by which those substances are again reduced to common matter.

This fermentation can never begin during the life of the part ; and probably it can only take place in animal and vegetable substances.

Life is a principle of self-preservation. Action is not immediately necessary to life, for there have been instances of people living some time after all motion had ceased, as in drowning and in a trance. People have lived for weeks in a trance, all motion having ceased during that time. That simple life does not depend on action is instanced in vegetables, they often continuing a long time quite inactive, as trees in winter, and seeds. I have kept seeds for three years without their growing, and they have afterwards vegetated.

According to the different dispositions, different parts are formed.

Organization is matter particularly arranged, so as to be capable of producing certain actions.

Sensation is active and passive ; it is performed by the brain and nerves. By passive sensation is meant the perception of any external impulse on the body ; which is accomplished by the medium of the senses. Active sensation is the *will*, by which ideas are brought forth in the mind, independent of external influence on the body.

Thus, then, in animals there is a compound action, that of life and the *will*. The will has no power over the actions of the internal economy.

It is by this compound action that instinctive operations are performed.

The internal economy is ruled by the combined powers of nerves, brain, and life, connected with each other ; each calls on the other to do its part. The harmony of the brain and nerves is health. This compound economy is set agoing as soon as sensation begins, which, perhaps, is not in utero.

Instinct is totally different from reason, for reasoning always terminates in consequences, whereas the actions performed by instinct have no final intention.

When the living principle wants nourishment, the feel of hunger is produced by the stomach sympathizing with every part of the body. In a child that sucks, when this affection is perceived, if its lips are touched, the *will* throws them into that action, called sucking. But if nourishment was not wanted, this effect could not have been produced. Thus, then, the living principle directs the will ; but this alone is not sufficient, for it is necessary that there should be some sensation on the lips, for the *will* to direct them to act. Hunger is only the second principle of action, the living principle being the first. In this instance it is the parts about the mouth only that sympathize with the mind, for if any other part is touched, it does not produce the action.

Sensation joined with a want of the living principle is necessary to put particular parts in action. A bird that has eggs forming within it, as soon as it sees proper materials to build its nest, takes them and flies to a proper place to deposit them ; and when it has laid its eggs, sits upon them. All this is done without any final intention, for it does every part as well the first time as ever after, gaining nothing by experience. In this instance the effects are produced in the same manner as in sucking. The bird has no sensation which can inform it of the formation of eggs, but from the sympathy which then takes place, when it sees the proper materials for its nest, it is directed by the will to take them up ; and again, the sensation of seeing a tree causes it to fly to it, and in like manner to deposit the materials on a particular part of it. Thus, then, the operations of instinct are carried on, and the sensorium is the medium by which they are performed ; first, by being directed by the living principle, and then directing the actions of the different parts to accomplish the necessary ends.

Sensation is a burden to life, and cannot be constantly supported for any considerable length of time. Sleep is the winder up of sensation. When perfect, it is a cessation of all sensation, present and past ; that is, an entire stop to all memory. Those animals which have no sensation, probably never sleep. Sleep takes up about one-third of the life of an animal. By disease it is sometimes preternaturally increased, and sometimes diminished. Life can go on without sensation, but sensation is sometimes necessary for its well-being. The fœtus in utero has not probably any sensation.

A swoon is a cessation of the actions of the living principle, when it is complete.

Fits are usually attended with a cessation of all sensation. I know a lady who frequently has

fits, in which she has a cessation of all active sensation, not having the least power of motion in any part; yet during that time passive sensation continues, for she knows everything that passes around her, hears, sees, feels, &c. as usual.

Disease is a preternatural action.

In all diseases the cause and effect ought to be carefully attended to. In some instances it is necessary to remove the cause to cure the disease. In other instances it is necessary to increase the cause to remove the disease.

THE STOMACH.—The principal distinction between animals and vegetables is that the former has a stomach, the latter not. This part is the agent which by hidden powers converts animal or vegetable matter into a part of ourselves; it is the true animal, every animal having it, whatever other parts are wanting. A polypus may be considered as one of the simplest animals, it is all stomach and parts of generation, the latter not being peculiar organs, but merely parietes of the stomach, which are its body, each part of which has the power of producing its like; its food is converted into chyle in the stomach, absorbents opening into this part take up the chyle, and these at some distance from their mouths become arteries.

The stomach is the seat of irritability, and connected with the whole body; in man the connexion is less intimate than that between the brain and the rest of the body, for any hurting cause applied to a distant part is always perceived by the brain. But every impression made on a part removed from the stomach does not affect it. Local injuries affect not the stomach, except they are so violent as to disorder the whole system in man, &c.

The stomach, so far as nourishment is concerned, is connected with every part of the body; and some parts, as the brain, testicles, and vital parts, have a peculiar connexion with it. It is a singular fact, that an injury done to tendinous parts, as a strain of the ligaments of a joint, produces sickness at the stomach, while the hurting of muscles, especially those of voluntary motion, makes little or no impression on it.

CASES

FROM THE EARLY NOTE BOOKS OF

SIR ASTLEY COOPER, BART.

EXTRACTED WITH PERMISSION OF B. B. COOPER, ESQ.

UMBILICAL HERNIA. OPERATION.

ON Tuesday, January 1st. I was called to Mrs. F—, who had an umbilical hernia, which became strangulated on Sunday, December 30th. It had been for many years irreducible, but a part of it could be returned. Some pea-soup she had eaten on Sunday, she imagined had caused the symptoms of strangulation.

The tumor was six inches in length, and inclined downwards. It was, as they always are, tense, but not red, but very painful when pressed. As various attempts had been made to reduce it without success, I immediately proceeded to perform the operation. She continued to lie on the bed.

A transverse incision was begun about three inches from the tumor,* and another at right angles with the former continued on to the apex. The skin was turned aside from the sac, and the former was so thin that the sac was immediately exposed. Having made a small opening into it, I passed a probe into the sac, and dilated it. No water escaped.

A portion of omentum enveloping a piece of the ileum was exposed; the former adhered to the sac, while the latter was placed in the centre of the omentum, was of a chocolate brown colour, and unadherent. I dilated the orifice of the sac downwards, in the direction of the linea alba, and returned the intestine; not by little and little with the finger, but by squeezing out its contents with my whole hand, and thus easily returned it.

The omentum I cut off, and was obliged to tie three arteries, which bled very freely. I left the rest to fill up the opening into the sac.

I made two sutures upon the wound, and applied lint and sticking-plaster upon it. She did well.

CUT-THROAT. RECOVERY.

Mr. S., a grocer at Nealwarth, in March 1799, cut his throat in two different places, namely, upon the larynx, and between the thyroid cartilage and os hyoides. The first was a very small opening, but the second would admit of the four fingers being passed into the pharynx. The epiglottis was separated, or at least a part of it, from the thyroid cartilage.

I brought the os hyoides† to the thyroid cartilage by five sutures, and made one on the integuments. Adhesive plaster was then placed on the wound, but so as to leave a small aperture for the escape of blood. He was ordered not to attempt to swallow, but on the following day he took, without permission, a considerable quantity of barley-water, and afterwards some more solid food, both of which he could now swallow with ease. The ligatures came away on the eighth day, and he never had a bad symptom. Great care was taken to support the head, and to bring it forward upon the chest.

TETANUS, WITH POST-MORTEM INSPECTION.

A man was admitted into St. Thomas's Hospital, who had a contused wound on the toe of his right foot. Ten days after his admission symptoms of locked-jaw supervened, of which locked-jaw he died on the seventeenth day after his admission.

DISSECTION.—*Abdomen.*—The stomach was found inflamed, and in three different parts slightly ulcerated. The colon had a spasmodic contraction in it, about four inches long, above the sigmoid flexure.

Chest.—The pericardium contained a small quantity of water, about an ounce. The right lung was inflamed, and the bronchial tubes contained purulent matter, but were not ulcerated.

Brain.—Was very firm and healthy in every respect. The body was opened two days after his death.

* A rough diagram shows that this incision was made between the base and the apex.

† This case shows, that as far back as the year 1799, Sir A. Cooper had applied in practice the idea of bringing together the os hyoides and thyroid cartilage, in cases of cut-throat. M. Bermond was not, therefore, as he imagines, the first surgeon who adopted this practice.—See No. xxviii., p. 28.