growth. But, if there be any truth in what I have urged to-day, we are witnessing a growth which promises to be as rapid as it has seemed to be delayed. Little spirit of prophecy is needed to foretell that in the not so distant future the teacher of physiology will hurry over the themes on which he now dwells so long in order that he may have time to expound the most important of all the truths which he has to tell, those which have to do with the manifold workings of the brain.

And I will be here so bold as to dare to point out that this development of his science must, in the times to come, influence the attitude of the physiologist towards the world, and ought to influence the attitude of the world towards him. I imagine that if a *plébiscite*, limited even to instructed, I might almost say scientific, men, were taken at the present moment, it would be found that the most prevalent conception of physiology is that it is a something which is in some way an appendage to the art of medicine. That physiology is, and always must be, the basis of the science of healing, is so much a truism, that I would not venture to repeat it here were it not that some of those enemies, alike to science and humanity, who are at times called antivivisectionists, and whose zeal often outruns not only discretion, but even truth, have quite recently asserted that I think otherwise. Should such a hallucination ever threaten to possess me, I should only have to turn to the little we yet know of the physiology of the nervous system, and remind myself how great a help the results of pure physiological curiosity—I repeat the words pure physiological curiosity, for curiosity is the mother of science—have been, alike to the surgeon and the physician, in the treatment of those in some way most afflicting maladies—the diseases of the nervous system. No, physiology is, and always must be, the basis of the science of healing; but it is something more. When physiology is dealing with those parts of the body which we call muscular, vascular, glandular tissues, and the like, rightly handled she points out the way not only to mend that which is hurt, to repair the damages of bad usage and disease, but so to train the growing tissues and to guide the grown ones as that the best use may be made of them for the purposes of life. She not only heals, she governs and educates. Nor does she do otherwise when she comes to deal with the nervous tissues. Nay, it is the very prerogative of these nervous tissues that their life is above that of all the other tissues, contingent on the environment and susceptible of education. If increasing knowledge gives us increasing power so to mould a muscular fibre that it shall play to the best the part which it has to play in life, the little knowledge we at present possess gives us at least much confidence in a coming far greater power over the nerve cell. This is not the place to plunge into the deep waters of the relation which the body bears to the mind; but this at least stares us in the face, that changes in what we call the body bring about changes in what we call the mind. When we alter the one we alter the other. If, as the whole past history of our science leads us to expect, in the coming years a clearer and clearer insight into the nature and conditions of that molecular dance which is to us the material token of nervous action, and a fuller exacter knowledge of the laws which govern the sweep of nervous impulses along fibre and cell, give us wider and directer command over the moulding of the growing nervous mechanism and the maintenance and regulation of the grown one, then assuredly physiology will take its place as a judge of appeal in questions not only of the body, but of the mind; it will raise its voice, not in the hospital and consulting room only, but also in the senate and the school.

One word more. We physiologists are sorely tempted towards self-righteousness, for we enjoy that blessedness which comes when men revile you and persecute you and say all manner of evil against you falsely. In the mother country our hands are tied by an Act which was defined by one of the highest legal authorities as a "penal" Act; and though with us, as with others, difficulties may have awakened activity, our science suffers from the action of the State. And some there are who would go still farther than the State has gone, though that is far, who would take from us even that which we have, and bid us make bricks wholly without straw. To go back is always a hard thing, and we in England can hardly look to any great betterment for at least many years to come. But unless what I have ventured to put before you to-day be a mocking phantasm, unworthy of this great Association and this great occasion, England in this respect at least offers an example to be shunned alike by her offspring and her fellows.

REFERENCE.

[1] *Rendiconti del Reale Istituto Lombardo.* vol. xii, p. 206.

AN ADDRESS
ON
SOME DISTINCTIVE CHARACTERS OF HUMAN STRUCTURE.

Delivered before the Anthropological Section of the British Association for the Advancement of Science, Toronto, August, 1897.

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[ABSTRACT.]

THE ERECT ATTITUDE.

WHEN we look at man and contrast his form and appearance with other vertebrate creatures, the first thing probably to strike us is his capability of assuming an attitude, which we distinguish by the distinctive term, the erect attitude. In this position the head is balanced on the summit of the spine, the lower limbs are elongated into two columns of support for standing on two feet, or for walking, so that man's body is perpendicular to the surface on which he stands or moves, and his mode of progression is bipedal. As a consequence of this, two of his limbs, the arms, are liberated from locomotor functions; they acquire great freedom and range of movement at the shoulder-joint, as well as considerable movement at the elbow and between the two bones of the forearm; the hands also are modified to serve as organs of prehension, which minister to the purposes of his higher intelligence. The erect position constitutes a striking contrast to the attitude assumed by fish, amphibia, and reptiles when at rest or moving, in which vertebrates the body is horizontal and more or less parallel to the surface on which they move. Birds, although far removed from the erect attitude, yet show a closer approximation to it than the lower vertebrates or even the quadrupedal mammals. But of all vertebrates, those which most nearly approximate to man in the position assumed by the body when standing and walking are the higher apes.

The various adaptations of structure in the trunk, limbs, head, and brain which conduce to give man this characteristic attitude are essential parts of his bodily organisation, and constitute the structural test which one employs in answering the question whether a particular organism is or is not human.

These adaptations of parts are not mere random arrangements, made at haphazard and without a common purpose; but are correlated and harmonised so as to produce a being capable of taking a distinctive position in the universe, superior to that which any other organism can possibly assume. If we could imagine a fish, a reptile, or a quadruped to be provided with as highly developed a brain as man possesses, the horizontal attitude of these animals would effectually impede its full and proper use, so that it would be of but little advantage to them. It is essential, therefore, for the discharge of the higher faculties of man, that the human brain should be conjoined with the erect attitude of the body. The passage of a vertebrate organism from the horizontal position, say of a fish, in which the back, with its contained spinal column, is uppermost, and the head is in front, to the vertical or erect position of a man, in which the back, with its contained spinal column, is behind, and the head is uppermost, may be taken as expressing the full range and limit of evolution, so far as the attitude is concerned, of which such an organism is capable. Any further revolution of the body, as in the backward direction, would throw the back downwards, the head backwards, and would constitute a degradation. It would not be an advance in the adaptation of structure to the duties to be discharged, but rather an approach to the relation of parts existing so generally in invertebrate organisms.

THE CURVES OF THE SPINAL COLUMN.

At the time of birth the infant's spinal column exhibits only two curves; one, corresponding to the true vertebræ, extends from the upper end of the neck to the lowest lumbar vertebra, and the concavity of its curve is directed forwards; the other and shorter corresponds to the sacro-coccygeal region and also has its concavity directed forwards. In the number and character of the curves, the newborn infant differs materially from the adult man, in whose spine, instead of one continuous curve from the neck to the sacrum, there are alternating curves, one convex forwards in the region of the neck, succeeded by one concave forwards in the region of the chest vertebræ, which again is succeeded by a marked convexity forwards in the vertebræ of the loins. The sacro-coccygeal region continues to retain the forward concavity of the newborn child. The formation and preservation of this alternating series of curves are associated with the assumption of the erect attitude, and the development of the lumbar convexity is correlated with the straightening of the lower limbs when the child begins to walk.

When the child is born, the curvature of its spine in the dorso-lumbar region approximates to that of an ordinary quadruped in which there is no lumbar convexity, so that the spine in that region presents one continuous curve concave forwards. For some time after its birth the infant retains the quadrupedal character of the spinal curve in the dorso-lumbar region, and, as it acquires nervous and muscular power and capability of independent movement, its mode of progression in the early months by creeping on hands and knees approximates to that of the quadruped. It is only after it has attained the age of from a year to sixteen months that it can erect its trunk, completely extend the hip and knee-joints, and draw the leg into line with the thigh, so as to form a column of support, which enables it to stand or move about on two feet. Hence there is this great difference between the young of a quadruped and that of a man, that whilst the former is born with the dorso-lumbar curve proper to its attitude, and which it retains throughout life, the child does not possess, either when born, or for some months after its birth, the characteristic spinal curves of the man. These curves are therefore secondary in their production; they are acquired after birth, and are not imprinted on the human spine from the beginning, though the capability of acquiring them at the proper time is a fundamental attribute of the human organism.

It has sometimes been assumed that the acquisition of the erect attitude by the young child is due to the fostering care of the mother or nurse; that it is a matter of training, encouragement and education, without which the child would not raise itself upon its feet. I cannot, however, agree with this opinion. If one could conceive an infant so circumstanced that, though duly provided with food fitted for its nutrition and growth, it should never receive any aid or instruction in its mode of progression, there can, I think, be little doubt that when it had gained sufficient strength it would of itself acquire the erect attitude. The greater growth in length of the lower limbs, as compared with the upper, would render it inconvenient to retain the creeping or the quadrupedal position.

There can, I think, be little doubt that muscular action plays a large part in the production of the cervical and lumbar convexities. The study of the muscles, associated with and connected to the spinal column, shows that large symmetrically arranged muscles, many of which are attached to the neural arches and transverse processes of the vertebræ, extend longitudinally along the back of the spine, and some of them reach the head. On the other hand, those muscles which lie in front of the spine, and are attached to the vertebræ, are few in number, and are practically limited to the cervical and lumbar regions, in which the spine acquires a convexity forwards.

Contemporaneous with the straightening of the lower limbs and the extension of the hip-joints, the spinal column itself is elevated by muscles of the back, named "erectores spinæ," which, taking their fixed points below, draw upon the vertebræ and ribs and erect the spine. The lumbar convexity is the form of stable equilibrium which the flexible spinal column tends to take under the action of the muscular forces which pull upon it in front and behind. It is probably due to the fact that the average pull, per unit of length, of the psoas muscles attached in front is greater than the average pull, per unit of length, of the muscles attached behind in the same region.

THE LOWER LIMB.

Sir William Turner then proceeded to consider the distinctively human characters of the bones in the thigh and leg which are associated with the erect posture, and passed on to an examination of the peculiarities of the human foot and hand, as contrasted with those of the apes.

THE CRANIUM AND BRAIN.

The power of assuming the erect attitude, the specialisation of the upper limbs into instruments of prehension, and of the lower limbs into columns of support and progression are not, he continued, in themselves sufficient to give that distinction to the human body which we know that it possesses. They must have co-ordinated with them the controlling and directing mechanism placed in the head, known as the brain and organs of sense.

The cranial cavity, with its contained brain, is of absolutely greater volume in man than in any other vertebrate, except in the elephant and in the large whales, in which the huge mass of the body demands the great sensory-motor centres in the brain to be of large size. Relatively also to the mass and weight of the body, the brain in man may be said to be in general heavier than the brains of the lower vertebrates, though it has been stated that some small birds and mammals are exceptions to this rule.

There is a general consensus of opinion amongst craniologists that the mean internal capacity of the cranium in adult male Europeans is about 1,500 c.cm. (91.5 cub. in.). The mean capacity of the cranium of fifty Scotsmen that I have measured by a method, which I described some years ago, was 1,493 c.cm. (91.1 cub. in.). The most capacious of these skulls was 1,770 c.cm., and the one with the smallest capacity was 1,240 c.cm. Thus, in a highly civilised and admittedly intellectual people, the range in the volume of the brain space amongst the men was as much as 530 c.cm. in the specimens under examination, none of which was known or believed to be the skull of an idiot or imbecile, whilst some were known to be the crania of persons of education and position. In twenty-three Scotswomen the mean capacity was 1,325 c.cm., and the range of variation was from a maximum 1,625 to a minimum 1,100 c.cm.—namely, 525 c.cm.

Again I have taken the capacity, by the same method, of a number of crania of the Australian aborigines, a race incapable apparently of intellectual improvement beyond their present low state of development. In thirty-nine men the mean capacity was only 1,280 c.cm. (78.1 cub. in.). The maximum capacity was 1,514 c.cm., the minimum was 1,044 c.cm. The range of variation was 470 c.cm. In twenty-four women the mean capacity was 1,115.6 c.cm., the maximum being 1,240 and the minimum 930, and the range of variation was 310 c.cm. It is noticeable that in this series of sixty-three Australian skulls, all of which are in the Anatomical Museum of the University of Edinburgh, eight men had a smaller capacity than 1,200 c.cm., and only four were above 1,400 c.cm. Of the women's skulls ten were below 1,100 c.cm., four of which were between 900 and 1,000 c.cm., and only three were 1,200 c.cm. and upwards.

It may now be of interest to say a few words on the capacity of the cranium in the large anthropoid apes. I have measured, by the method already referred to, the capacity of the skulls of five adult male gorillas, and obtained a mean of 494 c.cm., the maximum being 590 c.cm. and the minimum 410 c.cm., the range of variation being 180 c.cm. Dr. Delisle found the old male ourang (Maurice) which died a short time ago in the Jardin des Plantes, to have a capacity of 385 c.cm., whilst the younger male (Max) had a capacity of 470 c.cm. The mean of eleven specimens measured by him was 408 c.cm., which is somewhat less than the measurements of males recorded by M. Topinard and Dr. Vogt; but it should be stated that in some of Dr. Delisle's specimens the sex could not be properly discriminated, and possibly some of them may have been females. The cranial capacity of seven male chimpanzees is stated by M. Topinard to be 421 c.cm.

The determination of the mass and weight of the brain as expressed in ounces, and of the capacity of the cranial cavity as expressed in cubic centimetres, are only rough methods of comparing brain with brain, either as between different races of men, or as between men and other mammals. Much finer methods are needed in order to obtain a more exact comparison.

The Structure of the Brain.

By the employment of the refined histological methods now in use, it has been shown that the grey matter in the cortex of the hemispheres and in other parts of the brain is the seat of enormous numbers of nerve cells, and that those in the cortex, whilst possessing a characteristic pyramidal shape, present many variations in size. Further, that these nerve cells give origin to nerve axial fibres, through which areas in the cortex become connected, directly or indirectly, either with other areas in the same hemisphere, with parts of the brain and spinal cord situated below the cerebrum, with the muscular system, or with the skin and other organs of sense.

Every nerve cell, with the nerve axial fibre arising from and belonging to it, is now called a "neuron," and both brain and spinal cord are built up of tens of thousands of such neurons. It may reasonably be assumed that the larger the brain the more numerous are the neurons which enter into its constitution. The greater the number of the neurons, and the more complete the connections which the several areas have with each other through their axial fibres, the more complex becomes the internal mechanism, and the more perfect the structure of the organ. We may reasonably assume that this perfection of structure finds its highest manifestations in the brain of civilised men.

The specialisation in the relations and connections of the axial fibre processes of the neurons, at their termination in particular localities, obviously points to functional differences in the cortical and other areas, to which these processes extend. It has now been experimentally demonstrated that the cortex of the cerebrum is not, as M. Flourens conceived, of the same physiological value throughout: but that particular functions are localised in definite areas and convolutions. In speaking of localisation of function in the cerebrum, one must not be understood as adopting the theory of Gall, that the mental faculties were definite in their number, that each had its seat in a particular region of the cortex, and that the locus of this region was marked on the surface of the skull and head by a more or less prominent "bump."

The foundation of a scientific basis for localisation dates from 1870, when Fritsch and Hitzig announced that definite movements followed the application of electrical stimulation to definite areas of the cortex in dogs. The indication thus given was at once seized upon by David Ferrier, who explored not only the hemispheres of dogs, but those of monkeys and other vertebrates. By his researches and those of many subsequent inquirers, of whom amongst our own countrymen we may especially name Beevor, Horsley, and Schäfer, it has now been established that, when the convolutions bounding, and in close proximity to the fissure of Rolando are stimulated, motor reactions in the limbs, trunk, head, and face follow, which have a definite purposive character, corresponding with the volitional movements of the animal. The Rolandic region is therefore regarded as a part of the motor apparatus; it is called the motor area, and the function of exciting voluntary movements is localised in its cortical grey matter.

By the researches of the same and other inquirers it has been determined that certain other convolutions are related to the different forms of sensibility, and are sensory or perceptive centres, localised for sight, hearing, taste, smell, and touch.

The Paths of Conduction.

Most important observations on the paths of conduction of sensory impressions in the cortex of the convolutions were announced last year by Dr. Flechsig, of Leipzig, so well known by his researches on the development of the tracts o nerve fibres in the columns of the spinal cord, published several years ago. He discovered that the nerve fibres in the cord did not become myelinated, that is, attain their perfect structure, at a uniform period of time, so that some acquired their complete functional importance before others. He has now applied the same method of research to the study of the development of the human brain, and has shown that in it also there is a difference in the time of attaining perfect structural development of the nerve tracts. Further, he has discovered that the nerve fibres in the cerebrum become myelinated subsequent to the fibres of the other divisions of the cerebro-spinal nervous axis. When a child is born, very few of the fibres of its cerebrum are myelinated, and we have now an anatomical explanation of the reason why an infant has so inactive a brain and is so helpless a creature. It will therefore be of especial interest to determine, whether in those animals which are active as soon as they are born, and which can at once assume the characteristic attitude of the species, the fibres of the cerebrum are completely developed at the time of birth. Flechsig has also shown that the sensory paths myelinate before the motor tracts; that the paths of transmission of touch, and the other impulses conducted by the dorsal roots of the spinal nerves, are the first to become completely formed, whilst the fibres for auditory impulses are the last.

Flechsig names the great sensory centre which receives the impulses associated with touch, pain, temperature, muscular sense, etc., *Körpergefühlsphäre*, the region of general body sensation, or the somæsthetic area as translated by Dr. Barker. The tracts conducting these impulses myelinate at successive periods after birth. They pass upwards from the inner and outer capsules and the optic thalamus as three systems.[1] Some enter the central convolutions of the Rolandic area, others reach the paracentral lobule, the inferior frontal convolution, the insula, and small parts of the middle and superior frontal convolutions; whilst considerable numbers reach the gyrus fornicatus and the hippocampal gyrus, which Ferrier had previously localised as a centre of common or tactile sensibility.

The Rolandic area, therefore, is not exclusively a motor area, but is a centre associated also with the general sensibility of the body. The motor fibres in it are not myelinated until after the sensory paths have become developed. As the motor parts become structurally complete, they can be traced downwards as the great pyramidal tract from the pyramidal nerve cells in this area, from which they arise, into the spinal cord, where they come into close relation with the nerve cells in the anterior horn of grey matter, from which the nerve axial fibres proceed that are distributed to the voluntary muscles.

Flechsig's observations agree with those of previous observers in placing the visual centre in the occipital lobe; the auditory centre in and near the superior temporal convolution; and the olfactory centre in the uncinate and hippocampal convolutions. Of the position of the taste centre he does not speak definitely, although he thinks it to be in proximity either to the centre of general sensation, or to the olfactory centre.

The centres of special sense in the cortex, and the large Rolandic area, which is the centre both for motion and general sensation, do not collectively occupy so much as one-half of the superficial area of the convolutions of the cortex. In all the lobes of the brain—frontal, parietal, occipito-temporal, and insula—convolutions are situated, not directly associated with the reception of sensory impressions, or as centres of motor activity, the function of which is to be otherwise accounted for. These convolutions lie intermediary to the sensory and motor centres. Flechsig has shown that in them myelination of the nerve fibres does not take place until some weeks after birth, so that they are distinctly later in acquiring their structural perfection and functional activity. As the nerve fibres become differentiated, they are seen to pass from the sense centres into these intermediate convolutions, so as to connect adjacent centres together, and bring them into association with each other. Hence he has called them the association centres, the function of which is to connect together centres and convolutions otherwise disconnected.

The Association Centres.

We have now, therefore, direct anatomical evidence, based upon differences in their stages of development, that, in addition to the sensory and motor areas in the cortex of the human brain, a third division—the association centres—is to be distinguished.

If we compare the cerebrum in man and the apes, we find those convolutions which constitute the motor and sensory centres distinctly marked in both. An ape, like a man, can see, hear, taste, smell, and touch; it also exhibits great muscular activity and variety of movement. It possesses, therefore, similar fundamental centres of sensation and motion, which are situated in areas of the cortex, resembling in arrangement and relative position, though much smaller in size than, the corresponding convolutions in the adult human brain. It is not unlikely, though the subject needs additional research, that the minute structure of these centres resembles that of man, though, from the comparatively restricted area of grey matter in the ape, the neurons will necessarily be much fewer in number.

In the cerebrum of a newborn infant, whilst the motor and sensory convolutions are distinct, the convolutions for the association areas, though present, are comparatively simple, and do not possess as many windings as are to be seen in the brain of a chimpanzee not more than three or four years old.

Again, if we compare the brain of the Bushwoman, miscalled the Hottentot Venus, figured by Gratiolet and by Bischoff, or the one studied by Mr. John Marshall, with that of the philosopher Gauss, figured by Rudolph Wagner, we also recognise the convolutions in which the motor and sensory areas are situated. In all these brains they have a comparative simplicity of form and arrangement which enables one readily to discriminate them. When we turn, however, to the association areas in the three tiers of convolutions in the frontal lobe, and in the parieto-occipital and occipito-temporal regions where the bridging or annectant convolutions are placed, we cannot fail to observe that in a highly developed brain, like that of Gauss, the association convolutions have a complexity in arrangement, and an extent of cortical surface much more marked than in the Bushwoman, and to a still greater degree than in the ape. The naked-eye anatomy of the brain therefore obviously points to the conclusion that these association areas are of great physiological importance.

The problem which has now to be solved is the determination of their function. Prolonged investigation into the development and comparative histology of the brain will be necessary before we can reach a sound anatomical basis on which to found satisfactory conclusions. It will especially be necessary to study the successive periods of development of the nerve-fibre tracts in the cerebrum of apes and other mammals, as well as the magnitude and intimate structure of the association areas in relation to that of the motor and sensory areas in the same species.

Flechsig, however, has not hesitated to ascribe to the association centres functions of the highest order. He believes them to be parts of the cerebral cortex engaged in the manifestations of the higher intelligence, such as memory, judgment, and reflection; but in the present state of our knowledge such conclusions are of course quite speculative.

It is not unlikely, however, that the impulses which are conveyed by the intermediate nerve tracts, either on the one hand, from the sense centres to the association centres, or on the other, from the association centres to the sensory and motor centres, are neither motor nor sensory impulses, but a form of nerve energy, determined by the terminal connections and contacts of the nerve fibres. It is possible that the association centres, with the intermediate connecting tracts, may serve to harmonise and control the centres for the reception of sensory impressions that we translate into consciousness, with those which excite motor activity, so as to give to the brain a completeness and perfection of structural mechanism, which without them it could not have possessed.

Instinct and Reason.

We know that an animal is guided by its instincts, through which it provides for its individual wants, and fulfils its place in Nature. In man, on the other hand, the instinctive acts are under the influence of the reason and intelligence, and it is possible that the association centres, with the intermediate association fibres which connect them with the sensory and motor centres, may be the mechanism through which man is enabled to control his animal instincts, so far as they are dependent on motion and sensation.

The higher we ascend in the scale of humanity, the more perfect does this control become, and the more do the instincts, emotions, passions, and appetites become subordinated to the self-conscious principle which regulates our judgments and beliefs. It will therefore now be a matter for scientific inquiry to determine, as far as the anatomical conditions will permit, the proportion which the association centres bear to the other centres both in mammals and in man, the period of development of the association fibres, in comparison with that of the motor and sensory fibres in different animals, and, if possible, to obtain a comparison in these respects between the brains of savages and those of men of a higher order of intelligence.

The capability of erecting the trunk; the power of extending and fixing the hip and knee joints when standing; the stability of the foot; the range and variety of movement of the joints of the upper limb; the balancing of the head on the summit of the spine; the mass and weight of the brain, and the perfection of its internal mechanism, are distinctively human characters. They are the factors concerned in adapting the body of man, under the guidance of reason, intelligence, the sense of responsibility, and power of self control, for the discharge of varied and important duties in relation to himself, his Maker, his fellows, the animal world and the earth on which he lives.

Note.

[1] Drs. Ferrier and Aldren Turner communicated to the Royal Society of London a few weeks ago (*Proc. R. S.*, June 17th, 1897) an account of an elaborate research on the tracts which convey general and special sensibility to the cerebral cortex of monkeys. Their results were obtained by the aid of destructive lesions and the study of the consecutive degenerations in the nerve tracts. From the brief abstract in the *Proceedings*, their research, though conducted by a different method, harmonises with the observations of Flechsig on the human brain, in regard to the course and connections of the great thalamic cortico-petal sensory fibres. They have also traced association fibres in connection with both the visual and auditory systems.

THE SIGNS AND SYMPTOMS OF PERFORATED GASTRIC ULCER, WITH NOTES OF TWO CASES, IN ONE OF WHICH OPERATION WAS SUCCESSFUL.

BY

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Case I.

Notes by Dr. Adamson.

On the night of November 7th, 1896, I was called to see a domestic servant, who complained of sudden and severe abdominal pain. She was lying on her back in bed, with her knees slightly drawn up, her complexion pallid, with an anxious expression. She was perfectly conscious, and stated that the pain was on the left side of the abdomen at the level of the umbilicus. On inquiring into her past health she was found to have often suffered from indigestion characterised by pain after food. She had never vomited as far as she recollected, and certainly never had vomited blood. She had felt pain in the stomach that day, and especially at 8.30 p.m. after having partaken of steak, bread, and tea. At 10 p.m. she was suddenly seized with a violent pain in the abdomen, situated at the normal level of the lower curvature of the stomach. The pain gradually increased, but there was no vomiting or feeling of sickness.

When I saw her, at 10.15 p.m., in addition to the above she pointed to one specially tender spot just below the arch of the left ribs, and midway between the middle line and the