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A DESCRIPTION

OF SEVERAL SERIES OF UNUSUAL DISSECTIONS OF

THE

HUMAN BRAIN.

VOL. I.

DISSECTIONS OF THE CEREBRUM.

Edward B. Jamieson, M.B., Ch.B.

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INTRODUCTORY

GENERAL:

For a period extending over two years I have been engaged in the laborious task of demonstrating, by ordinary dissection processes, certain of the larger structures which make up the substance of the brain. The demonstration has entailed the production of several series, numbering in all between forty and fifty preparations, of a kind which, in these days, is but rarely, if ever, met with.

In these dissections a successful attempt has been made, by the use of forceps, aided to a slight extent by the scalpel, to show the course and naked-eye appearances of various tracts of fibres in their continuity, and also to show the form and pecularities of various masses of gray matter, either *in situ* or completely isolated.

When I first began this work the inducement was a certain element of curiosity following upon the accidental /

accidental exposure of the Lenticular nucleus from the outer side. During the process of cleaning and defining the nucleus, other deep-seated structures revealed, urged me to proceed further, not only for my own instruction, but also, in order that I might be able to bring these dissections in as aids to teaching the anatomy of the brain; for the average student has, as a rule, a considerable difficulty in appreciating the relationship of structures from those aspects which are presented to him by the prevailing mode of section: and it is probable that to the student mind the study of the internal structure of the brain would be made easier by the introduction into dissecting guides of directions for such of the simpler of these dissections as would not seriously interfere with those which are at present described.

But, as the preparations increased in numbers and began to arrange themselves in series, it appeared to me that they together with brief descriptions of the processes, and the discussion of some points which have arisen in connection with the display of certain structures in them, were to be deemed worthy of presentation to the University in the form of a thesis.

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The method adopted of presenting the thesis has been to give a short description of the steps of the dissection in each case, and to point out the structures which can be displayed by such a dissection; and, in addition, this has been extended, in some instances, to the further consideration of a few of the structures when it seemed that dissection threw a new light upon them, or when, by dissection, some of the problems which have arisen in regard to them could be, to some slight degree, elucidated.

Photographs of all the preparations have been introduced. Upon these the descriptions are based and continual reference is made to them. In order that the objects referred to in the text should be more clearly distinguished by being brought into relief the photographs are stereoscopic; and a suitable hand stereoscope is supplied. The important objects, or landmarks for them, in the specimens were numbered before the photograph was taken, and an index of the numbers is appended to each photograph. The numbers throughout the text refer to these. A separate, duplicate set of indexed sterograms, mounted on numbered cards, is also supplied, in order to overcome the inconvenience /

inconvenience of turning back several pages to refer to the photograph.

The specimens themselves form an essential and integral part of the thesis. They have been mounted in glass dishes. To each structure a number has been affixed, and a printed index list accompanies each specimen. They are placed on view in the gallery of the dissecting-room in the Anatomy department of the University, which appeared better adapted for this purpose than any other available space. (As some of the specimens have been only recently completed there may not be sufficient time to get these mounted during the vacation; in which case they will be placed on view, temporarily, in the microscopical room in the Anatomy department. They are the dissections of the Hippocampus major, the Superior cerebellar peduncles, the Fifth, Seventh and Eighth nerves.

In describing the specimens it is possible that greater detail has been entered into than is necessary. But the greater danger lay in the other extreme, for I am aware that anyone, suddenly confronted by these specimens or their photographs, has a difficulty in recognising the parts, owing to the unusual character of the dissection and the unfamiliar appearances presented by structures disclosed /

disclosed from an entirely new point of view. As the main principle is the same for all the dissections, and the mode of describing difficult to vary, there are in these descriptions certain phrases which constantly recur, owing to the lack of synonymous terms, and give them an additional element of tedium, of which no one can be more conscious than myself. This unavoidable phraseological repetition has been such that there are some expressions which I now regard with positive repugnance.

Ten of the photographic views which are included here are incorporated in the (as yet unissued) fifth section of the Stereoscopic Atlas of Anatomy, published by Messrs. Jack. These are Nos. I. II. III. VII. VIII. X., the part which shows the fillet in Nos. XVII., XXI., the lower specimen in No. XXXII. and the lower specimen in No. XXXIII. XXXIV.

ACKNOWLEDGMENTS:

My thanks are due, in the first place, to Professor Cunningham who, besides supplying me with the greater part of the necessary material, has throughout the whole period in which the work has been done aided me with practical suggestions and sympathetic encouragement. For referring me to literature, /

literature, and lending me books bearing on the work, I am indebted both to Professor Cunningham and to Dr. Alexander Bruce. I owe much also to the kindness of Professor Dixon of Dublin who supplied me during the course of this winter with four specimens of brains.

For the photographs I am indebted to the great kindness of Mr. Edward Burnet, who, notwithstanding the numerous calls on his time, and the trouble and inconvenience to which he has been put in helping me, has been ever ready to place his expert services at my disposal.

In a different sense I may include here the name of Professor Dejerine to whom I am beholden, not for personal services, but for the help I have obtained from his works on the Anatomy of the Nerve Centres. As my investigations have carried me over a widespread field, I have been able to dip but lightly into the vast literature which is the outcome of the concentration of specialised endeavour, during recent years in almost all civilised countries, towards unravelling the structure of the central nervous system by the mutually assisting methods, involving the study of Comparative Anatomy, Histology, Development, Myelination, Clinical and Experimental Pathology, and the building of Reconstruction models. But /

But the necessity for extensive reference, for the kind of work in which I have been engaged, is to some extent excluded by the wealth of information contained in Dejerine's books, which the more to read is the more to esteem for the perspicuity and felicity of ~~decision~~ diction, as well as for the detailed completeness of the contents.

HISTORICAL:

Our conception of the form and surface appearance of tracts of white matter and nuclei of gray matter is now largely built up from a study of macroscopic and microscopic sections at different levels and in different planes, and from schematic representations, and models constructed from these. An element of imagination and prejudice cannot be eliminated from these methods; and dissections showing the actual structure have obvious advantages.

Forgetting that there was nothing new under the sun, I had thought that there was originality both in the inception and the carrying out of this kind of work. But when I turned to old Atlases and books on Anatomy - for referring me to which I am indebted to Sir William Turner and to Professor O. Charnock Bradley - I found that there was in principle nothing new in these dissections. They are what Juvenal might term "Crambe repetita" (Juvenal VII. 154.). But I also found that I had gone /

gone beyond what the Old Anatomists had attempted.

The original descriptions of the structure of the brain were based not only upon large sections but upon dissections, carried out either on fresh specimens or on specimens hardened in spirit. The oldest works on Anatomy were not illustrated. I have examined a large number of illustrated anatomical works, ancient and modern, but most of them show only sections, or dissections of a simple character.

The oldest work illustrated by dissection, to which I could obtain access, was Vieussens 1685 (I). Both sections and dissections are represented The most ambitious of these shows the Corona radiata, Internal Capsule, Crusta, Pyramidal bundles in pons and the Pyramid of the Medulla, in continuity. His specimens, judged by modern standards, seem to have been none of the best and the drawings are poor.

There follows a long interval during which many works were published, but none illustrated by searching dissections, until 1810 when an Atlas by Gall and Spurzeim (II) appeared. In this Atlas there are several illustrations of good dissections, the best of which exhibits the Corona radiata and Internal Capsule from the outside - an illustration worthy of reproduction.

In /

In a small book on the Cerebellum by Reil (III), undated but which I computed to have been published between 1810 and 1820, there were included a drawing of the Tapetum, and another of the Optic radiation, both from their deep aspect. The drawings do not seem to have done justice to the dissections.

In 1827 Herbert Mayo (IV) published an Atlas which included, amongst others, illustrations of three very good dissections. One of them, showing the Corona radiata and Internal capsule, the Lateral fillet and Superior and Inferior cerebellar peduncles, is familiar as having been contained in older editions of Quains Anatomy (V). The other two are from better dissections. One shows the Fasciculus uncinatus, the Fasciculus longitudinalis Superior, and a part of the outer surface of the Lenticular nucleus. The other - a dissection of the brain from below and the inner side - shows the Tapetum, the Fasciculus uncinatus, the Bundle of Vieq d'Azyr, and the Anterior commissure in all its extent on one side.

In 1838 Frederick Arnold (VI) published, in the form of Anatomical Tables, a very beautiful series of illustrations of dissections of the brain. Although in some respects they are not in accordance /

accordance with what is regarded now as established fact, yet the following, with but slight modification, could stand present day criticism :-

(a) Pyramidal bundles and Fillet in the pons.

(b) The Fornix in its whole extent from the mesial aspect.

(c) The Posterior and Descending horns of the lateral ventricle from below; the Fascia dentata and Fraenulum of Giacomini; the Anterior white commissure.

(d) The Peduncles of the Cerebellum, the Fillets and the Pyramidal tract.

(e) The Cingulum, the Superior longitudinal fasciculus, Inferior longitudinal fasciculus, and the Intersection of the Corona radiata with the Corpus callosum.

In 1844, Foville (VII) brought out a great work on the nervous system, accompanied by an Atlas illustrating many admirable dissections, and the drawings and engravings are no less admirable than the specimens. Of the dissections one stands out amongst the others as a careful and laborious piece of work, not for the number of structures displayed, but for the care that must have been taken to preserve some of them while the others were being dissected. /

dissected. From the mesial aspect it shows nearly all the Cingulum, part of the Corona radiata and the Internal capsule; and the Superior and Inferior cerebellar peduncles.

With these illustrated in Foville's Atlas, dissection seems to have reached its high-water mark, and has steadily declined since. However, in the beautifully illustrated text book by Hirschfeld and Leveille (VIII) published in 1853, there are represented dissections showing the Pyramidal bundles and the Fillet in the pons, the Anterior commissure from below; and the Pyramidal bundles, the Crusta and the Internal capsule in continuity.

After an interval of nearly thirty years there appears in Schwalbe 1881 (IX) a dissection from the mesial aspect of the brain exhibiting the Tapetum and the Fasciculus longitudinalis inferior, and another showing the crossing of the fibres of the Middle cerebellar pedundle.

Four years later there is a slight recrudescence of dissection. In Meynert's Psychiatry (X) there are shown the Cingulum and the Fornix from the mesial aspect; the Lenticular nucleus, the Fasciculi longitudinales superior and uncinatus; the Corona radiata from the inner side; the Fillet and /

and the Internal capsule. This is the last work I can find showing special dissections, except for one or two of no great merit which are shown in Dejerine (XI).

I found, therefore, that many of my dissections were repetitions of what had been done in bygone days. But I was gratified to find that there was only which I had not done that I wished to emulate, and that there were many dissections which I had carried out which had not been attempted in those days.

The earlier part of the 19th Century seems to have been the most fertile in dissections, and the latter part to have become poorer and poorer till the last twenty years during which dissection of the brain of a burdensome kind has almost fallen into disuse. Naked eye examination of large sections, stained or unstained, is the prevailing mode, and this is supplemented by microscopical examination - to which we owe most of our knowledge of the intiimate structure of the brain. Attempts have also been made, by means of models, with a considerable degree of success, notably by Miss Florence Sabin, to exhibit objects, the idea of whose form had hitherto been derived from mental reconstruction.

The /

The method of dissection is, therefore, somewhat archaic; but that section cannot wholly supplant dissection I have endeavoured to show by means of my specimens which, in themselves, may be taken as a concrete appeal for the resuscitation of dissection.

METHODS:

The brains which I have employed have been treated in two different ways.

I. The fresh brain, having been placed in the skull cap with the view of preserving its shape, was injected with a 5% solution of formaldehyde. Thereafter it was placed in a solution of formaldehyde of the same strength.

Dissections of these brains are of a more attractive appearance owing to the bleaching of the tissues, but they are much more difficult to make than in the case of brains treated by the second method.

The distinction between gray and white matter is not so clear, and the fibreing of the white matter is not so visible; so that one has to be continually on guard against a false step. The outside of the brain is tough, while the interior, e.g. the Centrum ovale, is occasionally of a somewhat putty-like consistence.

II. /

II. By the second method the brain was in the first place injected <u>in situ</u>, with the rest of the body, by the ordinary arsenical preservative fluid. Pure formaldehyde solution was then forcibly driven into the cranial cavity through the orbit. By this method the brain is satisfactorily hardened, and its proper shape is perfectly retained. After its removal from the body it was immersed in a 5% solution of formaldehyde.

Such a brain is much easier to dissect than one which has been treated by formaldehyde alone. The different appearances of gray and white matter are very obvious. The fibreing of the white matter is distinct throughout. But it is darker in colour and as a mounted specimen it does not look so well. Frequent and prolonged washing under a rose-tap, however, considerably improves its appearance.

The length of time which a brain should be immersed in preservative and hardening fluid, before the dissection is commenced, does not appear to be, within limits, of any moment. None of the specimens I have employed have lain in formaldehyde for less than a month before dissection was begun; and many have not been touched for a year or more after their removal from the body. In the case of those which have been hardened <u>in situ</u>, the time which /

which elapsed before their removal from the head has also been inconstant. It has varied from a fortnight to three months. The difference depending upon the lapse of time was mainly in the discoloration, which was more ineradicable the longer the brain lay in the body.

I have not had an opportunity of dissecting a brain preserved in spirit; but the older Anatomists, before the finer naked eye dissections went out of fashion, were eminently successful in their efforts to display the internal structure of the brain hardened in this way.

For the dissecting no special instrument was required, nor any artificial aid to the eye. A sharp knife is useful on very special occasions and for trimming surroundings when the dissection is finished; but, as far as possible, I have resisted the temptation to use a knife, for it is difficult to calculate the depth of its point and a millimetre too far may do much damage.

An ordinary blunt pointed pair of forceps is required for rough dissecting. For the display of the actual structure in request I have used an ordinary pair of small-pointed forceps. Except in the case of smaller tracts the rough exposure accomplished /

accomplished by the blunt pointed forceps, sufficient to bring the structure into view, is easy; but the cleaning and the precise definition is a long, tedious process, for which the essential desideratum is not any special instrument, but an infinite patience: for many hours must be spent over one preparation. For this reason the membranes have to be retained until the dissection is completed. Each specimen undergoes so much handling in the long process of dissection that the surfaces are very much bruised when the membranes have been stripped off. Most of the dissections have been done at night; and for the purpose of making out the finer points the light requires not only to be exceedingly strong, but also to be overhead, so that few shadows are cast. It was found necessary, however, in many cases to defer the ultimate definition of smaller objects till clear daylight.

What has added much difficulty to many dissections has been the endeavour to retain as many of the neighbouring structures as was compatible with the full exposure of that sought for, in order that the relations might be taken in at a glance once that the structures had been recognised; and therein lies the contrast between section and dissection; for many sections are required to supply the information /

information given by one dissection. But the retention of relations increased the difficulty of access, and greatly prolonged the whole dissection.

Notwithstanding that many were self-suggested owing to the structure being met with in a prior dissection, yet in a great many cases I carried out an experimental or preliminary dissection on rather battered pieces of brain to serve as a guide, and to enable me to be more at home with a similar dissection on a brain good enough to be preserved as a permanent specimen. (For the International Anatomical Congress at Geneva, in August 1905, I had prepared a preliminary communication with a ground work of lantern slides of these specimens. To supplement it I took over a few of these "experimental" dissections. Owing to the breakdown of the lantern the only part of the communication carried through was the exhibition of the specimens).

S U B J E C T   M A T T E R:

An endeavour will be made to present the photographs in serial order, but that arrangement cannot hold good all through; for, in order to economise material there have been made, on some specimens, dissections which belong to two entirely different series.

DISSECTIONS OF THE CEREBRUM FROM THE OUTER ASPECT:

Two stages are omitted as uncalled for, as they do not belong to this category of special dissections. The first is the outer surface of the cerebrum, merely deprived of its membranes; and the second is that which exhibits the island of Reil. There are left three stages, but of the last three are two specimens shown. The first to be presented is :-

I. A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE SHOWING CERTAIN OF THE TRACTS OF LONG ASSOCIATION FIBRES FROM THE OUTER SIDE.

From the greater part of the outer surface, and from part of the under surface of the hemisphere, the gray matter of the cortex and the underlying white matter have been removed, as well as the island of Reil.

The tracts shown are the Fasciculus longitudinalis superior (1) with its occipital and temporal divisions /

PHOTOGRAPH NO. 1.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE OUTER SIDE TO SHOW CERTAIN TRACTS OF LONG ASSOCIATION FIBRES.

1. Superior longitudinal fasciculus.
2. Some of its occipital fibres.
3. Its temporal fibres.
4. Inferior longitudinal fasciculus.
5. Fasciculus uncinatus.
6. Optic radiation above the roof of descending horn.
7. Tapetum.
8. White matter of island of Reil.
9. Temporal pole.
10. Internal orbital convolution.

divisions (2 and 3); the Fasciculus longitudinalis inferior (4) and the Fasciculus uncinatus (5). Some of the inferior fasciculus, at its occipital end, and of the occipital fibres of the superior fasciculus have been removed, along with fibres of the optic radiation, to show the underlying Tapetum (7).

The photograph was taken with the anterior end of the hemisphere upwards, instead of on the left hand, for stereoscopic reasons, as the inferior fasciculus could be brought better into view by the left lens in this manner than was possible when the brain was placed in a more orthodox position. The attempt in this case, as in others, has not been very successful, but the fasciculus longitudinalis inferior (4) can be followed by the eye for a considerable distance forwards into the temporal lobe as an elevation immediately to the left hand side of the temporal fibres of the superior fasciculus.

The characters of the fasciculus uncinatus (5) can be made out with relative clearness: most compact where the figure 5 is placed - that is opposite the stem of the fissure of Sylvius; spreading into the frontal lobe above and in front, and into the extremity of the temporal lobe below.

The Fasciculus longitudinalis superior stands out /

out as a salient ridge, accentuated by extending the dissection a little inwards towards the superomesial margin, beyond the level of its bed. Its position and principal connections are very clearly shown, such as its association with the frontal lobe; its course backwards above the level of the lenticular nucleus which produces the bulging seen below it; the large and strongly arched complement of fibres which it supplies to the temporal lobe, and its feebler contribution to the occipital lobe.

The dissection like all others requires patience, but it exacts less time than do most.

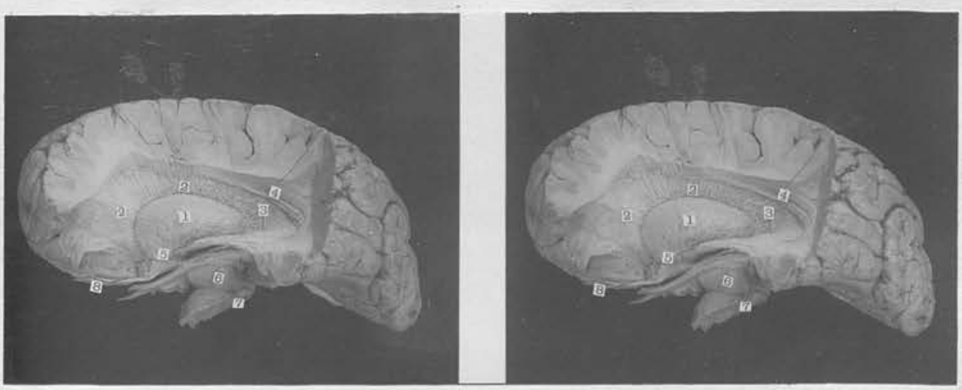
The Fasciculus longitudinalis inferior is absent in the Macaque brain (Ferrier and Turner XIII). I have tried to bring confirmatory evidence; but the Macaque brain upon which I worked had been kept too long in preservative to be suitable for dissection, and, while what I found would not have led me to make so positive an assertion, for the lower part of the bundle appeared to be represented, the result was inconclusive.

II. A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE OUTER SIDE TO SHOW THE OUTER SURFACE OF THE LENTICULAR NUCLEUS, THE BASE OR FOOTPIECE OF THE CORONA /

P H O T O G R A P H   N O. II.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE OUTER SIDE TO SHOW THE LENTICULAR NUCLEUS, THE BASE OF CORONA RADIATA, AND THE ANTERIOR COMMISSURE

1. Lenticular nucleus.
2. Corona radiata.
3. Optic radiation.
4. Superior longitudinal fasciculus.
5. Anterior commissure.
6. Crusta.
7. External geniculate body.
8. Olfactory peduncle.



CORONA RADIATA AND THE ANTERIOR WHITE COMMISSURE.

The opercula of the island of Reil, the island of Reil itself, the claustrum, the external capsule and the anterior part of the hippocampal convolution and the uncus, have been removed.

The virtual continuity between the Lenticular nucleus (1) and the anterior perforated spot is seen in this specimen. (The perforated spot is just below the figure 5.); and the grooves which are visible in a good light on the lower part of the surface of the lenticular nucleus indicate the position and course of the lenticulostriate and lenticulo-optic vessels as they ascend from the anterior perforated spot. (From a clinical standpoint, especially, I regard this dissection as one of the most instructive in the series; for it is impossible to obtain from actual or disgrammatic sections so comprehensive a grasp of the course of these arteries as is given here. When the specimen is placed side by side with one showing the Corona radiata and the basal ganglia from above (vide post), the significant relations of these arteries are at once obvious.

While all students are made aware of the primary importance of these vessels in certain classes of brain lesions, it is only with difficulty after /

after the careful study of serial sections, that the average man can piece together the information, so obtained, in such a way as to retain a permanent memory-hold upon these relations. The first part of their course presents the greatest difficulty to him and it is that part which is shown in this specimen).

Obersteiner (XIV. p. 342) affirms that "in hardened specimens it is very easy to peel off the external capsule from the nucleus lenticularis". This is only apparently so. The external capsule peels off, layer by layer very easily until the lenticular nucleus appears in sight, presenting a smooth and somewhat shining surface. But this smooth appearance is given, not by the gray matter of the surface of the nucleus, but by an exceedingly thin layer of fibres through which the gray substance of the nucleus can be seen. To strip this off can scarcely be accomplished without some laceration of the surface of the nucleus. The nearer the margin of the nucleus, the greater the difficulty. Hence it is very easy to obtain a fairly good view of the lenticular nucleus and to show its position and its contour in a general way; but to define its limits precisely, and to lay its outer /

outer surface entirely bare, requires both time and patience, although in dealing with a large structure with a firm consistence, where the contrast of colour is a dependable guide, the dissection can be carried on, comparatively speaking, with expedition.

The pin which supports the figure 5 is inserted into the anterior commissure, as it appears from under cover of the lenticular nucleus. A considerable portion of its radiate extremity has been cut away with the temporal lobe, so that only the posterior portion is left, mingled with other fibres in the temporal lobe.

A portion of the outer surface of the Corona radiata (2), including the optic radiation (3), is seen extending forwards and upwards and backwards towards the cortex. A portion of the superior longitudinal fasciculus (4) is also seen as it curves round the fissure of Sylvius to pass into the temporal lobe.

Some distance in front of the occipital pole there is a conspicuous curved sulcus. Beginning on the tentorial surface of the occipital lobe it extends obliquely forwards to the inferolateral margin near the prae-occipital notch, and ascends in a manner semilunar, with the convexity forwards, upon /

upon the lateral aspect of the hemisphere to end in front of the ramus occipitalis transversus, opposite the external parieto-occipital fissure. A fissure of this size and shape in this situation is abnormal; and my conclusions regarding it are negative rather than positive. None the less I have thought it worthy of brief consideration on account of its superficial resemblance to the Sulcus lunatus of Elliot Smith which at first led me into the error of identifying it as such.

Professor Elliot Smith has contributed at least two papers dealing with the Sulcus lunatus (XV. and XVI.) (It may not be out of place to put on record an appreciative tribute to the writings of Professor Elliot Smith, both for the subject matter, the value of which is admitted on all hands, and for his luminous style and masterly command of English; and, while his criticisms of the views of opponents may be somewhat trenchant, it leaves one in no doubt as to his own attitude).

In about 70% of Egyptian and Soudanese brains the area striata Gennari extends on to the outer surface of the occipital lobe as far as a little semilunar operculum, the anterior limit of which is the sulcus lunatus or "Affenspalte" (XVI). The Sulcus lunatus is identified with the lateral occipital /

occipital sulcus usually described in Human Anatomy (XV. p 81). When a well-marked operculum is present, there is a limiting sulcus lunatus. When the operculum has dwindled there is a lateral occipital sulcus "identical with the direction of the depth of the sulcus lunatus". In all the figures which accompany the two papers the sulcus lunatus and operculum are behind the ramus occipitalis transversus, and the letter press is to the same effect. Moreover, in no case does the sulcus cut into the infero-lateral margin. In my specimen the curved sulcus, besides being larger than any shown in Elliot Smith's paper, is in front of the level of the ramus transversus, and is continued on to the tentorial surface. The sulcus lunatus could only be in front of the ramus transversus if there were an overlapping by a very large operculum, as in the cercopithecidae. Such extensive overlapping is not found in human brains; and in this specimen there is not evidence at all of operculation. The sulcus is, therefore, not the sulcus lunatus.

As the membranes were retained over this region during the process of dissection, the peculiar character /

character of the sulcus was not observed until after the dissection was completed; and, although its distance from the area affected by the dissection is considerable, its identification in the absence of the temporal lobe cannot be absolute. The island of Reil was exposed in the other half of the brain, and hence, no help could be got from it.

The possibility which appeals to me at the present time is that it is formed by the union of an unusually well-developed unturned end of the inferior temporal sulcus, with a connecting branch from the occipito-temporal sulcus, or with a displaced inferior occipital sulcus. I do not think there can be any doubt but that the upper part of the furrow belongs to the lower temporal sulcus. The possibility that it is the inferior occipital which completes it below has suggested itself for this reason. According to Elliot Smith the posterior part of the inferior occipital fissure (which is always inconstant in form) may be swept on to the tentorial surface in Man as well as in the larger cebidae and the smallest cercopithecidae, and "as a rule its anterior extremity joins the fragmentary sulcus temporalis secundus" (XV). In figures 25 and 26 (XVI) slight displacement of the inferior occipital, /

occipital, and slight modification of the inferior temporal would make these correspond closely to the curved sulcus in my specimen. A still nearer approach is made in figure 42. There is now little security in confirmatory recognition of sulci on the outer side of the occipital lobe of my specimen as part of it is buried in plaster.

The last stage in the dissection from the outer surface is :-

III. A DISSECTION FROM THE OUTER SURFACE OF LEFT HALF OF THE BRAIN TO SHOW THE CONTINUITY OF THE CORONA RADIATA, INTERNAL CAPSULE, CRUSTA OF THE MID-BRAIN, PYRAMIDAL BUNDLES IN THE PONS AND THE PYRAMID OF THE MEDULLA.

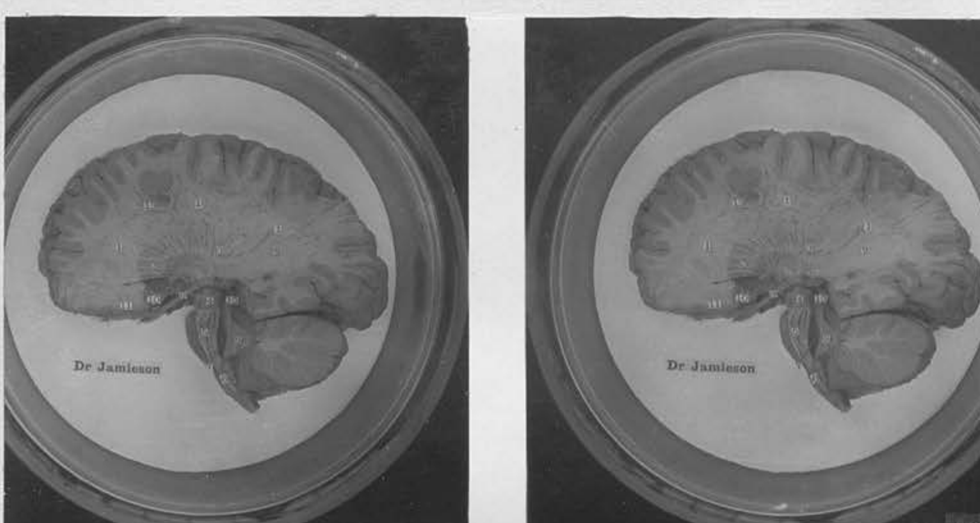
The gray and white matter of the convolutions of the outer surface of the cerebrum and of the island of Reil, the claustrum, the external capsule, and the lenticular nucleus, have been removed. Part of the cerebellar hemisphere has been sliced off. The transverse fibres of the pons and the nucleus pontis have been dissected away, thereby displaying the pyramidal bundles. The ventral surface of the mesial fillet is at the same time exposed.

In /

P H O T O G R A P H N O. III.

A DISSECTION OF THE LEFT HALF OF THE BRAIN FROM THE OUTER SIDE TO SHOW THE CONTINUITY OF THE CORONA RADIATA, INTERNAL CAPSULE, CRUSTA, PYRAMIDAL BUNDLES AND PYRAMID.

1. Corona radiata.
2. Optic radiation.
3. Internal capsule.
4. Crusta.
5. Pyramidal bundles in pons.
6. Pyramid of medulla.
7. Mesial fillet.
8. Middle cerebellar peduncle.
9. Optic tract.
10. Anterior commissure.
11. Internal orbital convolution.
12. External geniculate body.
13. A band of short association fibres.



In regard to its cerebral part the dissection is largely a repetition of its predecessor, but the corona radiata has been traced further towards the cortex and the lenticular nucleus has been removed. Both in front and behind, the fibres, or rather, bundles of fibres, can be followed almost to the cortex, as these regions of the corona do not suffer so much from intercrossing fibres. Above the lenticular nucleus the intersection with corpus callosum and the mingling with association fibres make it impossible to show the radiate character so distinctly except by artificial means; and artifact has been avoided throughout all the series.

In dissecting away the lenticular nucleus it is always possible to go too far, especially in front, owing to its connection with the caudate nucleus by means of thick gray laminae. This does not present a serious danger posteriorly where the laminae are feeble, but anteriorly, where the internal capsule is thin and the gray laminae are thick and numerous, much of the internal capsule may be removed accidentally.

The precise position of the lenticular nucleus, and the extent and limits of the internal capsule, are made /

made manifest by the presence of these laminae which break up the internal capsule and give it a radially ribbed appearance. As the corona radiata is altogether white the locus of its union with the internal capsule stands out as a well defined and strongly curved line which also serves as an index to the position of the convex margin of the lenticular nucleus.

Crossing the surface of the internal capsule is another curved white line, the greater part of which lies between the two figures 3. It represents the position of the external medullary lamina (of the lenticular nucleus), of whose fibres it is composed. In this case it runs more or less parallel to the line of union between the internal capsule and the corona, and divides the former into two parts: an upper, in relation to the putamen; a lower, in relation to the globus pallidus. The internal medullary lamina is never so conspicuous.

The anterior white commissure has been retained, and supported in position by a pin, in order that its relation to the internal capsule and to the (absent) lenticular nucleus might be seen from this point of view. It is indicated by the figure 10, but the pin leading from the figure to the commissure is indistinct. The genu of the internal /

internal capsule, seen on horizontal section, is represented here as a hollow above the commissure. The "genu" or bend which the lower anterior part of the internal capsule makes as it passes forwards into the frontal corona is here seen to be at, or near, the same level as the genu produced by the capsule being bent round the lenticular nucleus.

The optic tract (9) has been left in position as it permanently defines the upper end of the crusta, and does not interfere with the demonstration of continuity with the internal capsule.

The crusta (4) does not require any dissection.

The pyramidal bundles (5) have been exposed by tracing them downwards from the crusta. As so many of these bundles end in the pons the attempt to display them by following the pyramid of the medulla upwards cannot be attended with any great measure of success. The principle of this dissection is simple - the elimination from above downwards of the transverse fibres of the pons and the nucleus pontis. But, unless one were to be content with the demonstration of superficial bundles only, the extrication of the transverse bundles from amongst the longitudinal is a tiresome operation and consumes time far in excess of that required /

required for the corona radiata and internal capsule. The presence of the soft nuclei pontis facilitates the operation rather than otherwise.

Besides uncovering ~~the~~ and isolating the pyramidal bundles, the deeper transverse fibres of the pons behind the pyramidal bundles have been removed in order to make clear the position of the mesial fillet (7) and its relation to the pyramidal bundles and the pyramid (6).

IV. A DISSECTION TO SHOW: (a) THE CONTINUITY BETWEEN THE CORONA RADIATA, INTERNAL CAPSULE, CRUSTA, PYRAMIDAL BUNDLES IN THE PONS AND THE PYRAMID OF THE MEDULLA; (b) THE MESIAL AND LATERAL FILLETS, GOWERS' TRACT, SPINAL ROOT OF THE FIFTH CRANIAL NERVE, AND THE SUPERIOR AND INFERIOR CEREBELLAR PEDUNCLES.

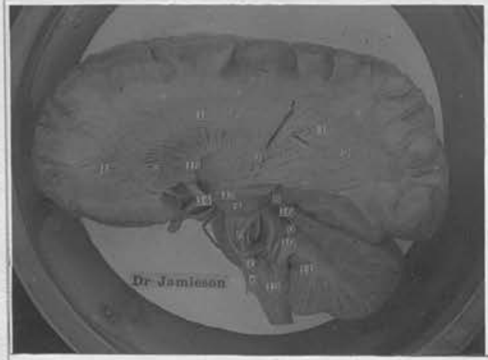
It was in this specimen that I made what might be termed my first attack upon fibred tracts, and, as I was then only feeling my way, the time taken up was beyond computation. It was this specimen which first suggested the possibility of an extensive and fairly comprehensive series of dissections.

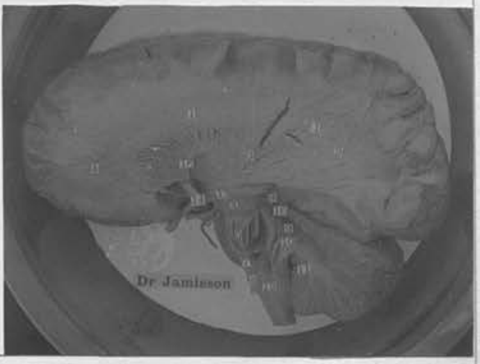
The dissection is, in its main features, similar to the last, but more detail has been made out /

PHOTOGRAPH. NO. IV.

A DISSECTION OF THE LEFT HALF OF THE BRAIN TO SHOW: (a) THE CONTINUITY OF THE CORONA RADIATA, INTERNAL CAPSULE, CRUSTA, PYRAMIDAL BUNDLES AND PYRAMID; (b) MESIAL AND LATERAL FILLETS, GOWERS' TRACT, SPINAL ROOT OF FIFTH NERVE AND SUPERIOR AND INFERIOR CEREBELLAR PEDUNCLES.

1. Corona radiata.
2. Optic radiation.
3. Internal capsule.
4. Crusta.
5. Pyramidal bundles.
6. Pyramid.
7. Mesial fillet.
8. Lateral fillet.
9. Superior cerebellar peduncle.
10. Inferior cerebellar peduncle.
11. Middle cerebellar peduncle.
12. Spinal root of fifth nerve.
13. Optic tract.
14. Anterior commissure.
15. External medullary lamina of lenticular nucleus.
16. Hippocampus major.





out, especially in the region of the pons. The corona radiata has been carried upwards closer to the supero-mesial margin. The origin and course of the optic radiation (2) is better shown in this specimen than in the last. The limits of the internal capsule can be defined as in the last, as well as the position of the external medullary lamina.

In this case the lamina is not parallel to the junction of Corona and capsule. They are further apart in front than behind. This is more in conformity with the real form of the inner surface of the putamen, for in a later photograph it will be shown that the surface of the putamen in relation to the internal capsule is much more extensive and anteriorly than it is posteriorly.

The pyramidal bundles in the pons have been dissected out with greater effect, and many of them, especially those which are deepest, are seen to stop short in the pons. One of the innermost of these longitudinal bundles passes outwards and downwards obliquely in front of the others, and, bending backwards by their outer side, it ends in the more dorsal part of the ventral division of the pons, a short distance above the upper end of the medulle. The connection with the fillet is only apparent. /

apparent. It was found necessary to leave some transverse fibres to support it. This bundle is not always present. It was not found in the specimen last described. But its presence is not a mere anomaly in this preparation. I have found it in more than one other specimen. But I am unable to find, or afford, any explanation of its position and course.

Behind the pyramidal bundles there is seen the concave ventral surface of the mesial fillet (7), and its marginal continuity with the lateral fillet is also shown in the specimen though the lateral fillet is somewhat concealed in the photograph. The pin supporting the figure 8 is inserted into it. The narrowing lower part of the fillet can be traced downwards to its disappearance behind the pyramid of the medulla.

Emerging from under the olive a small longitudinal strand is seen. It lies close to the outer edge of the fillet on a somewhat more dorsal plane, and it disappears, superiorly, behind the fillet. I have identified it as Gowers' tract, and it will be briefly discussed at a later stage.

Still further outwards is a larger bundle (12). That is the upper part of the spinal root of the fifth nerve. From its inner side the emerging trunk /

trunk of the seventh nerve has been removed.

Further out still is the inferior cerebellar peduncle (10) resting for a little on the pons, and bending sharply backwards into the cerebellum, where the fanlike character of its spreading out can be seen. Both roots of the eighth nerve and the middle cerebellar peduncle have been removed to expose it.

DISSECTIONS OF THE CEREBRUM FROM ABOVE.

The foregoing two specimens conclude the series of dissections from theouter side. Those following are the dissections which were made from above. They are in a somewhat irregular sequence, as dissections from above and from below do not lend themselves so readily to the formation of a series; and the sequence is further disturbed by the omission of such components as are merely ordinary dissections, for example, the floor of the lateral ventricle. The structures shown in this series are merely those of which a different view is given in the lateral dissections, and, as in the case of the lateral dissections, the first deals with long association tracts.

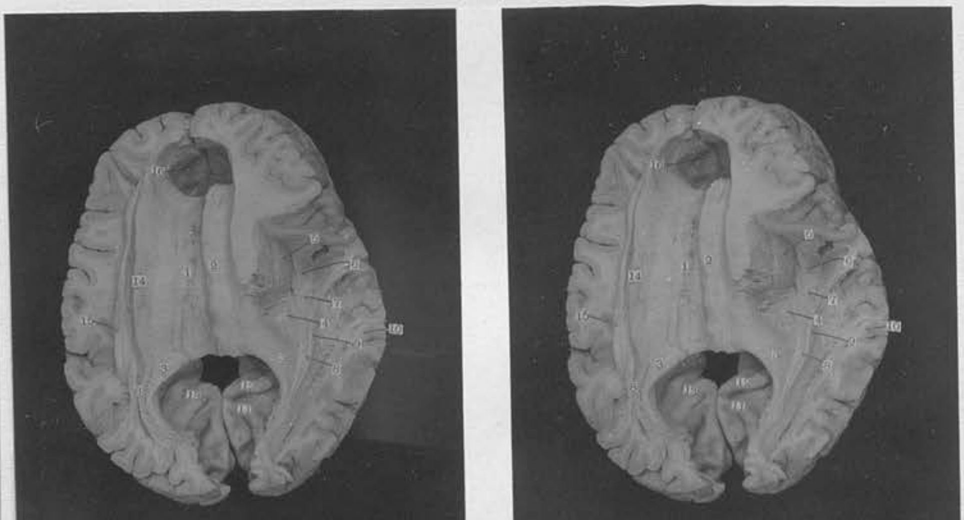
V. A DISSECTION OF THE CEREBRAL HEMISPHERES FROM ABOVE TO SHOW THE CORPUS CALLOSUM AND THE TRACTS OF LONG ASSOCIATION FIBRES OF THE CEREBRUM.

In this instance the brain substance has been removed down to the level of the corpus callosum, and its forceps major and forceps minor have been traced out. On the left side, by leaving a portion of the corona radiata (14), its relation to the corpus callosum and the line along which they intersect /

PHOTOGRAPH NO. V.

A DISSECTION OF THE CEREBRAL HEMISPHERES FROM ABOVE TO SHOW THE CORPUS CALLOSUM AND TRACTS OF LONG ASSOCIATION FIBRES.

1. Corpus callosum.
2. Cingulum.
3. Fibres to form tapetum.
4. Anterior edge of tapetum.
5. Lenticular nucleus.
6. Fasciculus uncinatus.
7. Anterior commissure.
8. Optic radiation.
9. Inferior longitudinal fasciculus.
10. Middle temporal convolution.
11. Posterior cuneo-lingual gyrus.
12. Anterior cuneo-lingual gyrus.
13. Floor of calcarine fissure.
14. Intersection of corona radiata and corpus callosum
15. Superior longitudinal fasciculus.
16. Marginal convolution.



intersect are shown. It is also shown that, posteriorly, the intersection to a large extent ceases and that the fibres about to form the Tapetum turn downwards under cover of the optic radiation (8). This is only seen in the position of the posterior horn of the ventricle. To show this further forwards it would have been necessary to remove the more superficial fibres of the corpus callosum.

By carrying the dissection to a somewhat lower level on the outer side of the corona radiata the superior longitudinal fasciculus (15) has been partly laid bare. A portion of it is seen passing backwards into the occipital lobe to the outer side of the figure 8, while the greater part of it is seen sinking downwards behind the Fissure of Sylvius,- that is the cleft just behind the level of the figure 15.

On the right side the Cingulum (2) has been preserved. The Cingulum which is seen here and the Cingulum shown in a dissection from the mesial aspect are both larger than usually represented. But no fibres have been left which do not run for some distance in the bundle. As Dejerine says, it is found in dissection that the fibres of the cingulum run in it only for short distances and are soon sent off into neighbouring convolutions. But, varying /

varying with their position, there are considerable differences in the length of their course in the bundle. The uppermost fibres have short courses, and those which run the shortest course have been removed in this specimen. In removing a cingulum piece-meal, the deeper fibres are found to run longer courses, especially near the centre, until the deepest fibres of all, opposite the centre of the bundle, extend, at any rate, from one end of the corpus callosum to the other.

A portion of the corona radiata including a considerable part of the optic radiation has been removed, with the object of tracing the fibres of the corpus callosum into the tapetum; but a satisfactory demonstration was not obtained owing to the small size of the horns of the ventricle and the softness of the white centre of the brain. The tapetum is, however, to some extent seen. The pin supporting the figure 4 is inserted near its anterior edge.

The posterior part of the outer surface of the lenticular nucleus has been laid bare by the process described before. From under cover of it are seen a part of the optic radiation extending backwards (8 pin), and a part of the foot piece of the corona radiata extending upwards. The exposure of the corona /

corona radiata serves to show the distance above the lenticular nucleus at which the intersection with the corpus callosum takes place.

Removal of a considerable portion of the cortex of the outer surface of the temporal and occipital lobes with the subjacent shorter association fibres haa exposed the outer aspect of the Inferior longitudinal fasciculus in the larger part of its extent. Some of the uppermost fibres of this bundle were taken away so that the edge of what remained of the optic radiation should be seen. There was less difficulty in distinguishing between the two different systems of parallel fibres than was anticipated. In stained sections the fibres of the inferior longitudinal fasciculus are readily distinguished by their large calibre and deeper colouring, and its bundles are separated from one another by fibres probably belonging to the thalamic radiation, and by fibres which pass through it at right angles to join the tapetum (Dejerine). In the dissection the fibres of the inferior longitudinal bundle were removed strip by strip, and when the optic radiation was reached it was at once recognised as comprising another system of fibres, notwithstanding this mingling and inter-crossing; for its outer surface, when freshly exposed, /

exposed, presented a different appearance - smoother and somewhat shining as though there had been an interval containing fluid between the two systems. This appearance, which was speedily lost on exposure, was, no doubt, due to the difference in the constitution and the closer setting of its fibres.

As Dejerine points out the association fibres in relation to the outer surface of the inferior longitudinal bundle run at right angles to it, so that it is at once distinguishable from the superjacent fibres when exposed from the outer side. The pin supporting the figure 9 is placed in the upper edge of the bundle near its middle.

The figure 10 is placed on the cut surface of the middle temporal convolution, but in estimating the level to which the dissection has been carried it must be noted that the cut surface exposed is oblique, and that the lower edge of the exposed surface of the inferior longitudinal bundle is therefore at a lower level than the middle temporal gyrus.

The expanded end of the anterior white commissure (7) (which appears in so many dissections) has been exposed and is seen extending from the under surface of the lenticular nucleus (5), outwards and backwards over the foot of the optic /

optic radiation (and the temporal radiation) to mix with the inferior longitudinal bundle in the white centre of the temporal lobe. Its whole extent will be shown in the following dissection.

In front of the commissure, and partly covering it, is a portion of the fasciculus uncinatus (6) arching round the stem of the Sylvian fissure and losing itself in the temporal lobe.

VI. A DISSECTION OF THE CEREBRAL HEMISPHERES FROM ABOVE TO SHOW THE TAPETUM OF THE CORPUS CALLOSUM AND THE ANTERIOR WHITE COMMISSURE.

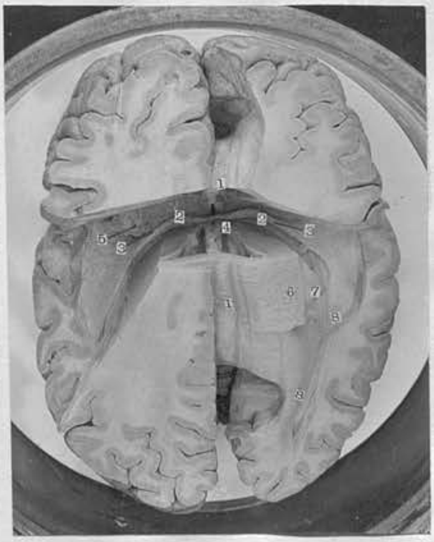
In so far as the tapetum is shown here this is the second stage in the dissection from above; but the anterior commissure should, from the depth of its position, appear in the last stage, albeit, like the tapetum, it was partly exposed from above in the last dissection. Both tapetum and commissure have been frequently exposed by other hands, but, none the less, it is not often that they are seen.

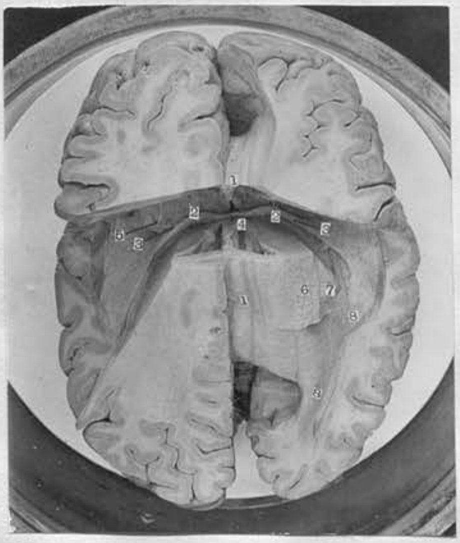
The brain was sliced down to the level of the corpsus callosum on the right side, and to within a short distance of that structure on the left. To expose the tapetum (8) the greater part of what remained of the cortex of the occipital, parietal and temporal lobes was dissected away, as well as the /

PHOTOGRAPH NO. VI.

A DISSECTION OF THE CEREBRUM FROM ABOVE TO SHOW THE TAPETUM AND THE ANTERIOR COMMISSURE.

1. Corpus callosum.
2. Internal capsule.
3. Anterior ~~end of body of Fornix~~. commissure
5. Position of anterior perforated spot.
6. Intersection of corona radiata and corpus callosum
7. Posterior part of island of Reil.
8. Tapetum.
4. Anterior end of body of Fornix.





the subjacent white matter, including the superior and inferior longitudinal fasciculi and the optic and temporal radiations. To expose its anterior part the removal of other structures is necessary, but that was done in exposing the commissure, which, in this instance, was dissected before the tapetum, and that portion of the dissection will be given in that connection.

The foot-piece of the optic and temporal radiations is shown as it lies in relation to the tail of the caudate nucleus and the taenia semicircularis, but they are not visible in the photograph.

It was found necessary, in order to fully expose the anterior end of the tapetum, to remove a part of the spread out extremity of the commissure - as may be seen by comparing the right side with the left.

The exposure of the tapetum proved to be a most tedious dissection and one that required the greatest caution. The fibres of the tapetum run, for the most part, almost at right angles to those of the overlying radiations. As the distinction between the two sets of fibres is therefore very clear, the dissection was expected to be easier than most. But, although the direction of the fibres /

fibres is so different, yet their relationship appeared to be very intimate, and a certain amount of interlacing to take place, so that in removing a bundle of occipital fibres great care has to be taken lest a portion of the tapetum should be torn away with it. The chief difficulty lies, however, in the relation of the tapetum to the hollow ventricle beneath. The tapetum yields before the forceps in laying hold of the deeper fibres of the radiation, and the increased pressure necessary to secure a grip is exceedingly liable to make a breach into the ventricle, especially near the lower edge of the tapetum where it is very thin.

As the tapetum is discussed at some length under another photograph it does not call for any further notice, here, beyond that the dissection is confirmatory of the belief that the tapetum is derived from the corpus callosum, and that it is continuous with the deeper fibres of that structure, as the cut edge of the superficial strata shows It may be noted that the lower edge of the tapetum, in its middle part, forms a gentle curve, concave downwards. This may to some extent be also seen in the dissection of the tapetum from the inner side, and it seems to be due to an increase of the bulk of the lower edge of the inferior longitudinal bundle /

bundle in this situation.

To expose the anterior white commissure (3) a portion of the corpus callosum near its anterior end has been lifted out together with a considerable part of the septum lucidum; and portions of the caudate and lenticular nuclei, the ~~claustrum~~ internal and external capsules, the claustrum, the island of Reil, and of the fronto-parietal and temporal opercula, have been removed. Portions of the last named structures also required removal to expose the anterior end of the tapetum.

The difficulty in this dissection lies in the great depth at which the commissure is placed, and the confined space in which the dissector has to work, unless more of the adjacent parts be sacrificed than can be allowed if the relations of the commissure are to be properly appreciated when the dissection is completed. The object has been not only to expose the commissure, but to preserve enough to show its relations to the caudate and lenticular nuclei and the internal capsule. Therefore, only the smallest possible segments of these structures have been lifted out and the sections have been made sufficiently oblique to show, in the specimen, their cut surfaces, in front and behind.

In /

In regard to the anterior commissure nothing need be said, except that it may be pointed out that the conventional description "horseshoe - shaped" does not seem applicable, owing to the width of its curve and the inclination forwards as well as outwards of the part in relation to the caudate nucleus and internal capsule. If a more or less familiar object is to be taken for comparison a bow meets the requirements better than a horse shoe.

The pins supporting the figures 2, 4, and 5, are inserted respectively into the cut surface of the internal capsule, the anterior end of the body of the fornix, and the outer part of the anterior perforated spot. The two anterior pillars of the fornix are seen passing downwards behind the commissure. The position of the anterior perforated spot is indicated in order to show the relation of the anterior commissure thereto. The two structures which bound the narrow cleft in the middle line in front of the commissure are the subcallosal gyri.

The obvious asymmetry between the two halves of the commissure is only accidental.

The following three photographs show specimens which /

P H O T O G R A P H   N O. VII.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM UPPER AND OUTER ASPECTS TO SHOW THE CORONA RADIATA AND ITS RELATION TO THE BASAL GANGLIA.

1. Corona radiata.
2. Optic radiation.
3. Temporal radiation.
4. Anterior commissure.
5. Lenticular nucleus.
6. Caudate nucleus.
7. Optic thalamus.
8. Taenia semicircularis.
9. Deep fibres of fasciculus uncinatus.
10. Temporal pole.
11. Posterior orbital convolution.
12. Floor of calcarine fissure.

which form a series by themselves, but they are most conveniently included as part of the otherwise short series from above.

VII. A DISSECTION FROM THE UPPER AND OUTER ASPECTS OF THE LEFT CEREBRAL HEMISPHERE TO SHOW THE CORONA RADIATA AND ITS RELATION TO THE BASAL GANGLIA.

With the exception that the temporal part of the corona radiata, the anterior commissure and the fasciculus uncinatus have been retained, the dissection carried out for the second of the views from the outer aspect of the brain has been repeated so as to expose the outer surface of the lenticular nucleus and the corona radiata. From above the brain has been sliced down to within a short distance of the corpus callosum. The corpus callosum with the callosal convolution, and the gyri on the mesial surfaces of the occipital and frontal lobes have been removed.

The view obtained by the ordinary dissection for the floor of the lateral ventricle, and the view of the lenticular nucleus in No. II. are here combined. The lenticular nucleus (5), the caudate nucleus (6) and the optic thalamus (7) are all seen as viewed from above, and their positions relative to one another can be grasped more satisfactorily by this method of dissection than by any /

any other. From between the nuclei the corona radiata (1) is seen extending "cortical-wards". The presence in it of the intersection with the corpus callosum may be disregarded.

If the positions of the posterior extremities of the optic thalamus and the lenticular nucleus are compared, the existence of a retro-lenticular part of the internal capsule can be made out here as clearly as on section, and from it the occipital and temporal radiations (2 and 3) can be observed passing to their respective lobes.

As in the first of the series from above, the anterior commissure (4) can be seen overlapping the temporal radiation before it is lost in the white substance of the lobe. In front of the anterior commissure the arched form of fasciculus uncinatus (9) is seen as it bends round the stem of the Sylvian fissure.

PHOTOGRAPH No. VIII.

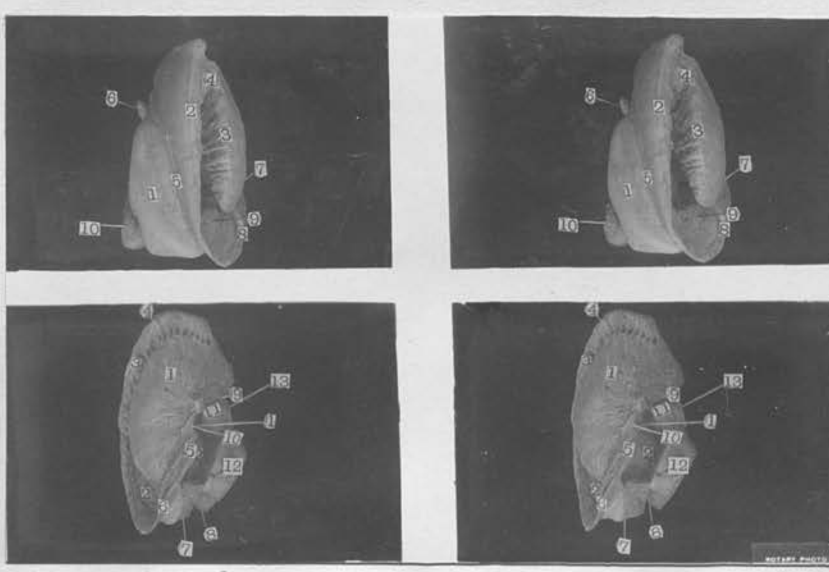
A DISSECTION OF THE OPTIC THALAMUS AND THE BASAL GANGLIA OF THE RIGHT SIDE.

View from above.

1. Optic Thalamus.
2. Caudate Nucleus.
3. Lenticular Nucleus.
4. Connecting Laminae.
5. Taenia Semicircularis.
6. Anterior Pillar of Fornix.
7. Amygdaloid Nucleus.
8. Tail of Caudate Nucleus.
9. Deep surface of External Geniculate Body.
10. Pineal Body.

View from Outer Side.

1. Lenticular Nucleus.
2. Outer surface of Optic Thalamus.
3. Caudate Nucleus.
4. Connecting Laminae.
5. Amygdaloid Nucleus.
6. Tail of Caudate Nucleus.
7. External Geniculate Body.
8. Internal Geniculate Body.
9. Anterior Perforated Spot.
10. Anterior Commissure.
11. Anterior Fibres of Crusta.
12. Crusta.
13. Anterior Pillar of Fornix.



In rational sequence there follows:-

VIII. A DISSECTION OF THE BASAL GANLIA AND THE OPTIC THALAMUS OF THE RIGHT SIDE LARGELY ISOLATED FROM SURROUNDING STRUCTURES.

That portion of the cerebrum which consists of the island of Reil, the basal ganglia, the capsules of the lenticular nucleus and the optic thalamus, together with the one half of the mid-brain was cut out from the surrounding brain substance.

The island of Reil, the claustrum (the only one of the basal ganglia of which no part has been here retained), and the external capsule were removed to expose the outer surface of the lenticular nucleus.

The internal capsule was dissected out from between the caudate nucleus and the optic thalamus on the one hand and the lenticular nucleus on the other hand. In doing so the laminae which unite the head of the caudate nucleus to the anterior part of the lenticular nucleus were retained. By the removal of the internal capsule, the deep surfaces of the nuclei between which it is situated have been exposed.

The anterior part of the amygdaloid nucleus was removed to show the anterior white commissure on /

on the under surface of the lenticular nucleus. Most of the anterior perforated spot was taken away, but a small portion was retained to show its relationship to the grooves on the outer surface of the lenticular nucleus, in which lay the lenticulo-striate and the lenticulo-optic vessels, and to show its intimate relation to the lenticular and caudate nuclei. The optic tract was divided at the point where it breaks up into its two roots, and was removed. Ths upper part of the crusta of the mid brain was lifted out, excepting its innermost and most anterior fibres.

Two views of this dissection are shown : one from above and one from the outer side.

The view from above shows the general configuration, position and relations of the structures and is to a large extent an extension of the appearances presented in an ordinary dissection of the lateral ventricle. But parts of the deep and outer surfaces of the lenticular nucleus (3) are seen, and owing to the removal of the internal capsule the relation of the lenticular nucleus to the optic thalamus (1) and the caudate nucleus (2) from this point of view are seen as well as if not better than in the preceding dissection. The laminae /

laminae of gray matter (4) uniting the nuclei are to some extent shown. These laminae were retained with great difficulty, and only in front where they are best marked. Posteriorly they were removed with the internal capsule, but their existence along the whole length of the lenticular nucleus is indicated by the ridges on its deep or inner surface. The corresponding ridges on the caudate nucleus are seen in the view of the dissection from the side.

The deep surface of a large part of the tail of the caudate nucleus is seen from this aspect (8); but in the dissection it was found expedient, owing to the tenuity and instability of the parts, to leave some of the fibres of the foot piece of the Corona (or retrolenticular part of the internal capsule) in relation to the taenia semicircularis, in order to support it, and, consequently, the deep surface of that structure is not seen.

A small part of the outer surface of the posterior end of the optic thalamus and the deep aspect of the external geniculate body (9) are in view. The pin bearing the figure 7 indicates the position of the amygdaloid nucleus.

In the view from the outer side the deep aspect of the caudate nucleus is seen in so far as it /

it lies above the level of the lenticular nucleus. In the neighbourhood of the figure 3 are the ridges which indicate the existence of laminae uniting the nuclei, while in front are the upper edges of the laminae which have been retained (4). It can be seen that, as one passes forwards, the interval between the nuclei for the internal capsule becomes narrower, and the laminae shorter and more closely set until, finally, the head of the caudate nucleus and the anterior end of the lenticular nucleus cohere.

The tail of the caudate nucleus (6), in this case, split into two parts separated by white matter, some distance behind its termination in the amygdaloid nucleus (5). This is not a constant occurrence, for in another specimen, in which a dissection of a similar nature was carried out, the tail of the caudate nucleus proceeded undivided to its termination.

On the convex outer surface of the lenticular nucleus (1) the grooves for the arteries and the small openings where they enter the substance of the nucleus are rather better seen than in photograph No. II, and they can be traced downwards to the outer part of the anterior perforated spot. (9 pin).

Between /

Between the anterior perforated spot and the amygdaloid nucleus is the anterior commissure (10).

The outer or deep surface of the optic thalamus is almost altogether obscured by the lenticular nucleus, but a small part of it posteriorly is seen where the left hand figure 2 is placed. The right hand figure 2 lies on the subthalamic region, rather than on the optic thalamus.

The pin which supports the figure 1 is inserted into the under surface of the lenticular nucleus, and although the specimen was placed with its anterior end upwards, instead of towards the right, in order to bring this surface partly into view stereoscopically, the attempt has not been successful.

The anterior and innermost fibres of the crusta leading up to the internal capsule are indicated by the figure II.

The dissection was one of the most prolonged of the whole group, even after some degree of proficiency in this kind of work was acquired. For once that a certain stage has been reached the lenticular nucleus is so liable to break away, and the taenia semicircularis and the tail of the caudate nucleus are in such continual danger of rupture, that the most careful handling is necessary, and the later stages can only be completed by the removal of minute portions at a time.

The /

The specimen appears again in the next photograph together with its counterpart from below, and some isolated lenticular nuclei which constitute the last stage in the dissection from above. A similar isolation of the caudate nucleus in all its extent is scarcely possible, for it cannot hold together in the last stages of the isolation of its tail.

IX. DISSECTIONS OF ISOLATED LENTICULAR NUCLEI.

Owing to a mistake these were not photographed until they had been mounted with other specimens. Specimen B is that which has ~~not~~ just been described. Specimen A. has not been described, but it is merely the counterpart of B, and shows the inferior aspect. The dissection was substantially the same, but more of the optic tract, the anterior perforated spot and the amygdaloid nucleus have been retained to enhance its value.

In the case of the lenticular nuclei all the surroundings were removed with care, and the surfaces cleaned. In two of them the anterior commissure has been left in its groove.

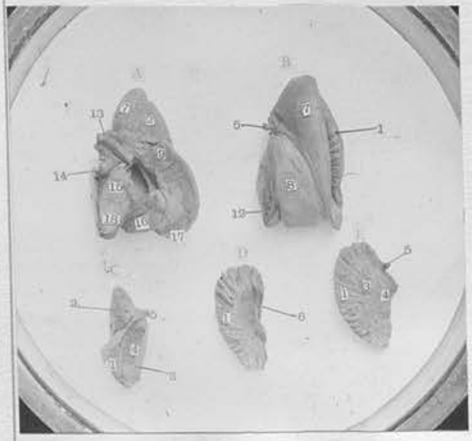
All the specimens are situated with their anterior ends directed away from the observer.

Specimen C. shows the inferior surface of the lenticular /

PHOTOGRAPH NO. IX.

DISSECTIONS OF OPTIC THALAMUS AND BASAL GANGLIA, AND OF ISOLATED LENTICULAR NUCLEI.

1. Putamen.
2. Outer surface of lenticular nucleus.
3. Outer nucleus of globus pallidus.
4. Inner nucleus of globus pallidus.
5. Anterior commissure.
6. Groove for anterior commissure.
7. Caudate nucleus.
8. Optic thalamus.
9. Amygdaloid nucleus.
12. Pineal body.
13. Optic Chiasma.
14. Corpus mammillare.
15. Crusta.
16. Posterior end of optic thalamus.
17. Corpus geniculatum externum.
18. Tegmentum.



lenticular nucleus from a right hemisphere; parts of the outer surface (2) and of the inner surface are also in view. The figure 1 is laid upon the putamen just behind the anterior commissure. There is only about one-sixth of an inch of the putamen uncovered by the globus pallidus posteriorly, and the position of the external medullary lamina can be made out indistinctly. All that is seen in front of the commissure is putamen. The figure 4 is placed on the inner nucleus of the globus pallidus which occupies a great part of this aspect and forms the internal projecting angle. Only a small part of the external nucleus of the globus pallidus is visible (3).

Specimen D. is the putamen only and belongs to the left side. The anterior commissure is related mainly to the putamen and almost the whole of its groove (6) is therefore shown. The ridged area is that part which lies in relation to the internal capsule. The greater breadth of this part in front than behind was noticed in connection with the photograph IV. and is conspicuous here as well as on Specimen E. Between the ridged district and the groove for the anterior commissure is the smoother concavity in relation to the globus pallidus.

Specimen /

Specimen E. is also from the left hemisphere. The deep or inner surface of the nucleus is shown. The figures 1, 3, and 4 indicate respectively the putamen, the outer nucleus of the globus pallidus and the inner nucleus of the globus pallidus. The extent to which these three, severally, contribute to make up the inner surface is seen, for the positions of the medullary laminae are indicated by curved lines.

P H O T O G R A P H   N O. X.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE MESIAL ASPECT TO SHOW THE CINGULUM AND FORNIX AND BUNDLE OF VICQ d'AZYR.

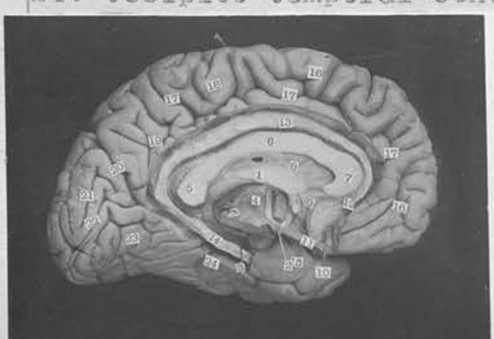
1. Body of fornix.
2. Corpus mammillare.
3. Fimbria.
4. Optic Thalamus.

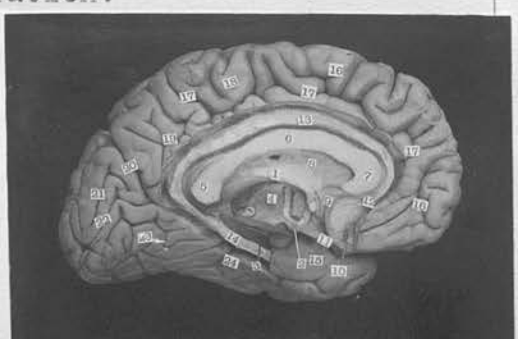
5,6,7, Splenium, body and genu of corpus callosum.

8. Septum lucidum.
9. Subcallosal gyrus.
10. Olfactory peduncle.
11. Optic chiasma.

12, 13, 14, Cingulum.

15. Uncus.
16. Marginal convolution.
17. Calloso-marginal fissure.
18. Paracentral lobule.
19. Post-limbic sulcus.
20. Internal parieto-occipital fissure.
21. Cuneus.
22. Posterior calcarine fissure,
23. Lingual convolution.
24. Occipito-temporal convolution.





DISSECTIONS OF THE CEREBRUM FROM THE INNER ASPECT.

As on the outer so on the inner side, the ultimate object is the exposure of the corona radiata and the internal capsule. There are four steps involved in the process, and as in the two former series the first of these deals with a long association tract. A part of the ubiquitous rhinencephalon is also included.

X. A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE MESIAL ASPECT TO SHOW THE POSITION AND COURSE OF THE CINGULUM, THE WHOLE EXTENT OF THE FORNIX, AND THE BUNDLE OF VICQ D'AZYR.

To expose the cingulum, most of the callosal convolution, the isthmus and the hippocampal convolution have been removed. In addition, the gyrus dentatus and part of the hippocampus major have been taken away, to display the fimbria The gray matter covering the anterior pillar of the fornix in the lateral wall of the third ventricle has been dissected away, and the bundle of Vicq d' Azyr has been traced through the optic thalamus to its termination in the anterior nucleus. The olfactory bundle of the fornix has been displayed, passing downwards in front of the anterior commissure and entering the gyrus subcallosus. The inner side of the corpus mammillare has been sliced off /

off, to show the central gray nucleus and its white envelope derived from the fornix. The posterior end of the gyrus rectus has been taken away with the anterior extremity of the callosal convolution to show the internal root of the olfactory tract (10) and its continuity with the subcallosal gyrus.

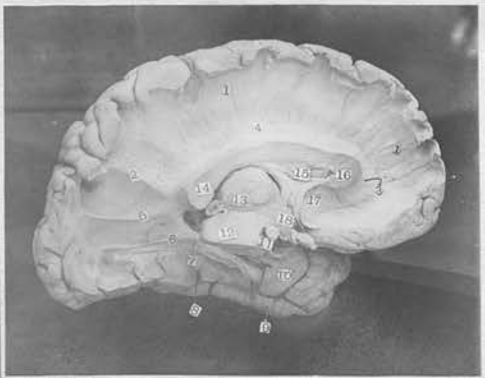
Apart from the account of the dissection no special description of this specimen is called for. Beyond the demonstration of the olfactory bundle of the fornix and, perhaps, the continuity of the mesial root of the olfactory peduncle and the gyrus subcallosus there is nothing essentially uncommon in the dissection. But although the various parts of the cingulum and fornix are frequently shown in dissections of the brain, it is not usual to see the whole extent of these structures in one view of a single preparation.

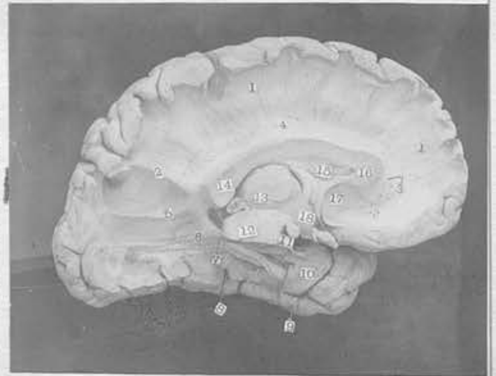
A point which may be noted in this specimen is the large extent of the septum lucidum (8) - of which only the lamina proper to this side is shown here, - and the capaciousness of the fifth ventricle. The extent of the septum lucidum is still better seen in the other half of this brain on which the dissection showing the gyrus dentatus is made. In brains hardened after removal from the body /

P H O T O G R A P H   N O. X1.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE MESIAL AND TENTORIAL ASPECTS TO SHOW THE INTERSECTION OF THE CORONA RADIATA WITH THE CORPUS CALLOSUM, AND THE DISTRIBUTION OF THE SPLENIAL FIBRES.

1. Corona radiata.
2. White centre of quadrate lobule.
3. Fibres from genu of corpus callosum
4. Fibres from body of corpus callosum.
5. Forceps major.
6. Lower or accessory forceps major.
7. Fibres from splenium to hippocampal convolution.
8. Outer wall of occipito-temporal sulcus.
9. Anterior end of occipito-temporal convolution.
10. Uncus.
11. Third cranial nerve.
12. Tegmentum.
13. Optic Thalamus.
14. Splenium.
15. Septum Lucidum.
16. Genu.
17. White matter covering head of caudate nucleus.
18. Third ventricle above the recesses.





The second step in the exposure of the corona and the internal capsule is :-

XI. A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE MESIAL AND TENTORIAL ASPECTS SHOWING THE INTERSECTION OF THE CORPUS CALLOSUM WITH THE CORONA RADIATA, AND THE DISTRIBUTION OF THE SPLENIAL FIBRES OF THE CORPUS CALLOSUM.

The gray matter and underlying white matter of the greater part of the mesial and tentorial surfaces of the hemisphere have been removed, leaving the uncus, the temporal pole, and the portions adjoining the supero-mesial, infero-lateral and internal orbital margins. The striae longitudinales, the subcallosal gyrus and the variously named gray strip related to the splenium, have been scraped away from the corpus callosum; and the fibres of the corpus callosum which radiate upwards with the innermost fibres of the corona rdaiata have been removed.

The corona radiata (1) is seen extending upwards from the intersection towards the cortex. The thick ridge upon which the figure 2 is placed is that part of the corona which runs upwards in the white core of the lobulus quadratus. Between 5 and 6 is the calcarine fissure. Figure 5 is placed on the forceps major, and 6 upon the fibres of /

of the splenium which run backwards below the floor of the posterior horn of the lateral ventricle into the lingual convolution. The pin which supports the figure 7 is inserted into the fibres of the splenium which extend forwards into the hippocampal convolution.

The shrunk, crumpled and opaque septum lucidum may be contrasted with that shown in the last photograph. In this case the brain was hardened after removal from the body.

The dissection is one of a not unusual type except in regard to that part of it which shows the distribution of the fibres of the splenium. The dissection of that region I have found the most difficult of any I have undertaken, and I have experienced several failures in the attempt to give a satisfactory demonstration.

The inferior part of the forceps major which extends backwards below the calcarine fissure is well shown in this specimen. It is a well-marked bundle of fibres and can be displayed without much difficulty, although particular mention of it is usually omitted from current English text books of Anatomy. Dejerine (XI), however, describes it in detail, and gives its connections with the upper and larger forceps major. It is connected with the forceps major by two sheets of fibres /

fibres, one on the outer side and one on the inner side of the posterior horn of the ventricle. That on the outer side is included as part of the tapetum, and was shown in photograph VI. and another aspect of it will be given in photograph No. XIII. That on the inner side is excessively thin and lies in the bottom of the calcarine fissure next to the ependyma of the ventricle. To display it constitutes the chief difficulty in this dissection, not only on account of its thinness, but also, because lying next to the ventricular cavity it lacks support, and is ruptured by the forceps on the application of very little pressure. In this case the hippocampus minor was large and the sheet of fibres broader than usual and more readily operated upon; and the posterior part of the ventricular cavity was obliterated by the approximation of its outer and inner walls, so that the support given to it by the outer wall rendered the dissection easier. This condition did not obtain anteriorly and some of the association fibres had to be left, as they could not be removed without tearing away the underlying sheet of splenial fibres and the ependyma. The fibres which compose this sheet run like those of the forceps more or less parallel to the long axis of the horn, and in the /

the dissection, therefore, they could be distinguished from the overlying association fibres which curved obliquely from ~~above~~ below upwards and backwards round the bottom of the calcarine fissure.

The group of fibres (lower forceps major) which runs backwards in the lingual gyrus cannot be traced very far as a distinct bundle. It becomes mingled with the fibres of the lower edges of the occipital part of the interior longitudinal bundle which curves inwards so as to lie below the calcarine fissure and the floor of the posterior horn.

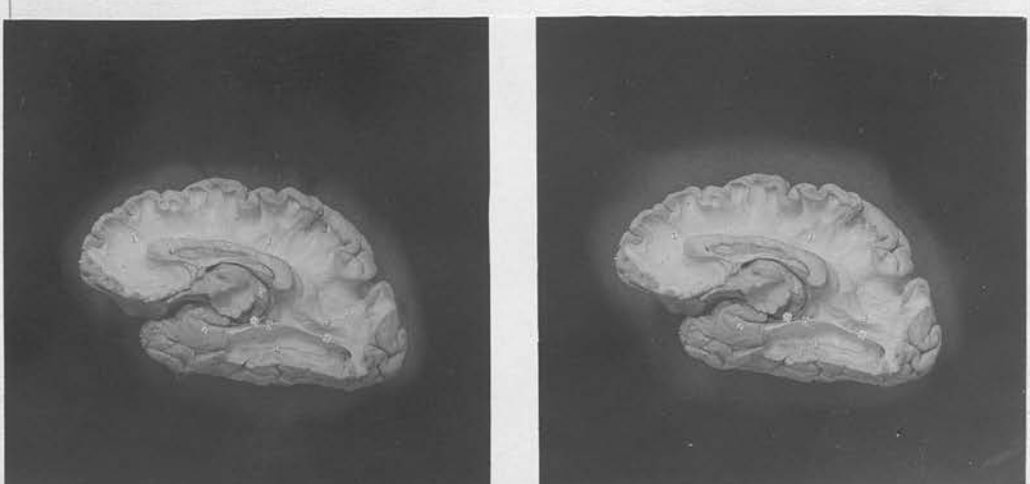
The fibres of the splenium in Man enclose the posterior horn of the lateral ventricle. Above and below there are the forceps major and the inferior forceps major; on the outer side the tapetum; on the inner side the thin lamina connecting the two forcipes. The degeneration which results from section of the splenium of the corpus callosum in the Macaque seems to show that splenial fibres are absent from the inner side of the occipital horn. According to Ferrier and Turner (XIII), "At either pole of the posterior horn of the lateral ventricle, in frontal sections, there is situated a cup-shaped mass of fibres, joined together along the external wall of the ventricle, which two masses of fibres and the intermediate connection /

PHOTOGRAPH NO. XII.

A DISSECTION OF THE RIGHT CEREBRAL HEMISPHERE TO SHOW THE INTERSECTION OF CORPUS CALLOSUM AND THE CORONA RADIATA, AND THE DISTRIBUTION OF THE FIBRES OF THE SPLENIUM.

—

1. Corona radiata.
2. Corpus callosum
3. Forceps major.
4. Accessory forceps major.
5. Fibres of splenium passing forwards.
6. Inferior longitudinal bundle.
7. Uncus.
8. Fimbria.
9. Pulvinar.



connection form the occipital prolongation of the forceps corporis callosi". The "masses" I take to correspond to the upper and lower forceps major, and the connection represents the occipital part of the tapetum. There is no evidence of even a very thin layer of fibres between these "cup-shaped masses" on the inner side of the horn.

In all the brains in which I have dissected this region I have found fibres running obliquely forwards into the white substance of the hippocampal convolution. They are not numerous and soon become mixed with other fibres especially those of the cingulum. To preserve them has in every case been a matter of difficulty owing to their small number, their mingling with other fibres, and the sudden bend which they make as they leave the splenium to pass forwards.

A photograph (No. XII) of another specimen showing the same dissection is inserted, as the tilt of the specimen shows these fibres better. The figure 5 lies on them. The figure 4 indicates the lower or accessory forceps major, which is here mingled with association fibres. The oblique direction of the short association fibres in the bottom of the calcarine fissure can be seen in this photograph.

Dejerine, who deals more exhaustively with the corpus callosum than any other author of whom I/

I am aware, does not refer to these fibres, nor to any contribution of callosal fibres to the hippocampal gyrus, except what may be included, by implication, in the general statement that the corpus callosum unites all parts of the cerebral mantle except the anterior part of the temporal lobe and the olfactory lobe. Some of these fibres run nearly longitudinally, some obliquely. The oblique fibres tend to be uppermost, and I have received corroborative evidence of their presence in dissections of the floor of the descending horn of the ventricle.

PHOTOGRAPH NO. XIII.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE MESIAL AND INFERIOR ASPECTS TO SHOW THE TAPETUM, OCCIPITO-FRONTAL BUNDLE, FORNIX, BUNDLE OF VICQ - d' AZYR, and the stria medullaris.

1. Ascending fibres from corpus callosum.
2. Forceps major.
3. Tapetum.
4. Fimbria.
5. Tegmentum.
6. Corpus mammillare.
7. Inferior peduncle of optic thalamus.
8. Body of fornix.
9. Caudate nucleus.
10. Occipito-frontal bundle.
11. Uncus.

The third stage in this series is :-

XIII. A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE MESIAL AND INFERIOR ASPECTS TO SHOW THE TAPETUM OF THE CORPUS CALLOSUM, THE OCCIPITO-FRONTAL FASCICULUS, THE FORNIX, THE BUNDLE OF VICQ D'AZYR, AND THE STRIA MEDULLARIS.

The gray and white matter of the mesial convolutions, excepting those along the margin, has been removed down to the level of the callosal radiation, and the corpus callosum has been cut away. On the inferior aspect all the brain substance below the cavities of the posterior and descending horns of the ventricle has been removed. The ependyma has been scraped off, exposing the deep surface of the tapetum on the outer wall of these horns. The tail of the caudate nucleus has been removed to define the free, anterior edge of the tapetum. By removal of gray matter of the lateral wall of the third ventricle the anterior pillar of the fornix, a portion of the bundle of Vicq d'Azyr, and of the inferior peduncle of the optic thalamus have been exposed. By scraping away the ependyma constituting the taenia thalami, the underlying stria medullaris has been laid bare and may be seen extending along the optic thalamus from the habenular region to the anterior pillar of the /

the fornix which it joins on its external aspect.

(In the photograph the brain is placed with its anterior end upwards in order that the free edge of the tapetum and the occipito-frontal bundle should both be brought into view. In regard to the fasciculus the attempt has not been so successful as was hoped for).

The fornix (8) was shown in the first of this series, but a dissection of it was made in this specimen also as it was less obscured by surrounding structures. The position and termination of the fimbria could be better demonstrated and the connection with the stria medullaris could be shown. In the photograph the fimbria is indicated by the pin which supports the figure 4. But the mid-brain overhangs it so that, while there is no difficulty in seeing it in the actual specimen it can scarcely be distinguished in the photograph. The Olfactory bundle running down in front of the anterior commissure was also shown in the former specimen. But it is better seen here, and the commissure is seen to be clasped between it and the anterior pillar. The figure 6 lies on the mammillary body from which the bundle of Vicq d'Azyr extends upwards to disappear under cover of a lamina of fibres (7) largely formed from the inferior /

inferior peduncle of the optic thalamus. The structure seen in the loop formed by the anterior pillar and the bundle of Vicq. d'Azyr is merely an untouched part of the lateral wall of the third ventricle.

The three figures 3 lie on the tapetum. (Adhering to the definition of Reil, I have employed the term tapetum as signifying the thin layer of fibres which forms the supero-external walls of both the descending and the posterior horns of the ventricle. There are two other definitions. Burdach limited the term to so much of the layer as lies in relation to the descending horn (Dejerine). Professor Arthur Robinson (XVII) includes under the term the lower fibres of the corpus callosum which form the roof of the body of the lateral ventricle).

One gets a better view of the extent of the tapetum when the dissection is made from this aspect, and its limits can be more clearly defined. The dissection itself is easier, for in scraping away the ependyma, the tapetum is supported on its outer side and does not yield before the pressure of the forceps, as is the case when the attempt is made to display the outer surface of the tapetum The extent to which the tapetum enters /

enters into the formation of the roof and outer wall of the posterior and descending horns of the ventricle is more clearly made out, when it is seen from within; and, further, the removal of the tail of the caudate nucleus which can only be satisfactorily carried out from this aspect, serves the double purpose, (a) of demonstrating the sharpness and definition of the anterior margin of the tapetum, and (b) by the exposure of the foot piece of the corona radiata, of showing the close relationship of the optic radiation to the tapetum. (The foot piece of the corona radiata has the appearance of a furrowed band in front of the free edge of the tapetum. The furrows are produced by the removal of the gray matter of the intersecting laminae which connect the caudate and lenticular nuclei). The lowest of the figures 3 lies on that part of the tapetum which forms the outer wall of the posterior horn and connects the forceps major proper with the lower forceps major. The ridge or band of fibres which is seen on the right hand side of this figure 3 is the inferior longitudinal bundle which curves inwards under the posterior horn as previously stated. With it are mingled fibres of the lower forceps major.

The /

The continuity of the fibres of the tapetum with the splenium and the deeper part of the posterior end of the body of the corpus callosum is even more obvious than in the dissection from the outer surface; and at the same time they can be seen to be added to by the fasciculus occipito-frontalis (10).

The fasciculus occipito frontalis is a well-defined bundle, though small. Its fasciculi are loosely arranged, and in consequence the bundle is soft and portions of it are apt to be removed accidentally, unless considerable care be exercised, especially in the removal of the corpus callosum which lies immediately above it. It is situated on the inner side of the corona radiata just below the corpus callosum, above and partly external to the caudate nucleus. Its relation to the caudate nucleus is variable and depends upon the extent of the interval which exists between the outer edge of the caudate nucleus and the insertion of the corpus callosum into the substance of the hemisphere. In brains which have been hardened after their removal from the body, this interval is usually very small, and frequently absent. In such a case the occipito-frontal bundle lies almost entirely under /

under cover of the caudate nucleus of which a correspondingly large part has to be removed to expose the bundle. In brains which have been hardened in situ the cavity of the lateral ventricle is of considerable capacity. (The brains of the subjects prepared for dissection in the Anatomy department of the University have been in late years, in all cases, hardened in situ, and the size of the cavity is frequently such as to suggest a minor degree of hydrocephaly). The cavity of the body and anterior horn of the lateral ventricle of these brains possesses what might be termed an outer wall, consisting of (a) a somewhat triangular space between the head of the caudate nucleus and the body of the corpus callosum at its junction with the genu, and (b) a fairly broad linear strip between the body of the caudate nucleus and the body of the corpus callosum.

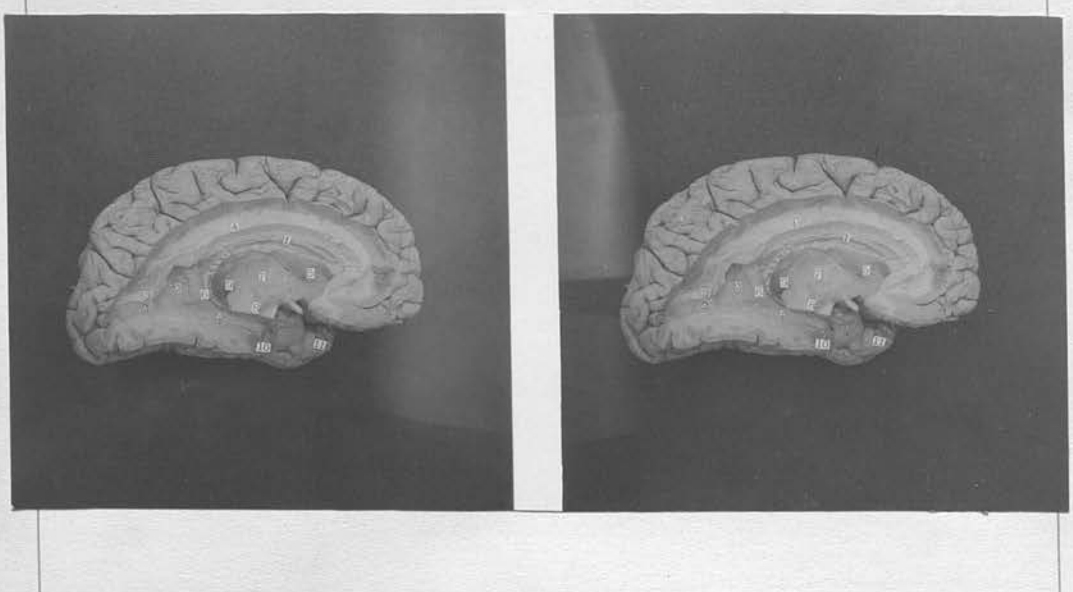
The occipito-frontal bundle lies along this interval. In front, in the triangular area it is removed some distance from the head of the caudate nucleus and is covered by the ependyma only. Further back it is covered by the ependyma, but its lower edge is in relation to the body of the caudate nucleus, part of which, therefore has in almost all cases to be removed for its complete exposure.

I /

PHOTOGRAPH NO. XIV.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM THE INNER SIDE TO SHOW THE TAPETUM AND THE OCCIPITO-FRONTAL BUNDLE.

1. Occipito-frontal bundle.
2. Tapetum.
3. Forceps major.
4. Intersection of corpus callosum and corona radiata
5. Caudate nucleus.
6. Bed of caudate nucleus.
7. Optic thalamus.
8. Red Nucleus.
9. Pulvinar.
10. Amygdaloid tubercle.
11. Temporal pole.



I have dissected out this bundle in several brains, and only in one instance it was unnecessary to remove any part of the caudate nucleus. When the brain is hardened after removal from the body, the bundle, on transverse section, presents a triangular outline, as may be seen in the photograph. The base rests on the corona radiata and the apex projects inwards, as is described by Dejerine. But in the second class of case the bundle presents on its inner aspect a longitudinal groove in its whole length. The upper lip of the groove is in contact with the corpus callosum, the lower lip is in relation to caudate nucleus. A second photograph No. XIV. of another specimen is included to show this latter condition.

The bundle as a whole is arched in conformity with the corpus callosum to which it is closely applied throughout. In front it is flattened and expands slightly and disappears into the genu of the corpus and forceps minor with which its fibres mingle. Its fibres also mingle with those of the corona radiata as may be seen in the last dissection of this series. Its bulk is greatest near its anterior end. Diminishing gradually in size as it passes backwards, it again spreads out at its posterior end, and joins the anterior free edge /

edge of the tapetum in which its fibres, now greatly diminished in number, seem to be lost.

I have described the bundle with considerable detail as it is one over which there is some controversy. It is in accordance with the detailed description of the occipito-frontal bundle given by Dejerine, except in one important particular.

Dejerine's account of it may be epitomised as follows: The fasciculus occipito-frontalis is a bundle of long association fibres, sagittal in direction, placed in the outer angle of the lateral ventricle, on the inner side of the foot piece of the corona radiata, below the corpus callosum and above the caudate nucleus. It describes a curve which is open downwards and forwards, and it is covered in all its length by the ependyma and the sub-ependymal gray matter. It is about half a centimetre in thickness and is pyriform on section, the base resting on the corona radiata, the apex, directed upwards and inwards, insinuating itself between the corpus callosum and the ependyma. It is well defined at the level of the head and body of the caudate nucleus, but it is, in part, broken up at the level of the tail by fibres of the corona radiata and the corpus callosum. Arrived at the level of the "carrefour ventriculaire" /

ventriculaire" the bundle curves downwards and forwards and its fibres spread out fanwise to form the tapetum. In front its fibres arise in the frontal cortex and are distinguishable from those of the corona and the corpus callosum by the fact that they are less deeply coloured after staining. As it runs backwards it gives off fibres to the subependymal gray matter, and fibres which pass through the corona radiata to join the external capsule. In the "spheno-occipital" lobe the fibres, after having formed the tapetum, are distributed to gyri on the outer surface and the infero-lateral border of the lobe. At the level of the "carrefour ventriculaire" and especially at the level of the occipital horn they probably mingle with fibres of the forceps major, judging from the result of limited lesions of the occipital lobe. The occipito-frontal bundle connects the occipito-temporal lobe to the frontal lobe, the "convexity of the hemisphere" and the insula; and consists, like other long association bundles, of fibres of unequal length which lie in the bundle only in one part of their course. It differs from other long association bundles in its deep sub-ependymal position on the inner side of the projection system.

In the foregoing rather lengthy resume fibres are /

are said to be given off to the subependymal gray matter and to the external capsule. This would apparently account for the diminution in size of the bundle as it passed backwards. This diminution is not an accident of dissection. It was observed in each of the dissections in which the bundle was laid bare; and it is also observable in the coronal sections described in Dejerine's work, although in these sections it cannot be so clearly made out, owing to the absence of sharp definition between the bundle and its surroundings. But it is axiomatic that fibres in an association bundle proceed in both directions and fibres enter it as well as leave it along its whole course. If the distribution of fibres from an association bundle to adjacent cortical areas (and the reception of fibres from these areas into the bundle) were more or less equal throughout, the bundle would maintain a uniform size for a considerable distance, as the cingulum exemplified. The gradual and steady increase in bulk of the occipito-frontal fasciculus may be construed to mean that a larger number of its fibres are connected with the frontal lobe than with any of the other regions which give to, or receive contributions from, the bundle.

According /

According to Dejerine the occipito-frontal bundle corresponds to a bundle described by Meynert (XVIII) as the corona radiata of the caudate nucleus, and by Wernicke (XIX) "Faisceau du corps calleux se rendant à la capsule interne". (Balkenbundel zur inneren Kapsel). Meynert's view that the fibres of the bundle arise in the caudate nucleus and are distributed to the gyri of the upper margin of the hemisphere, finds no acceptance with either Wernicke or Dejerine. Wernicke believed that the fibres come from the genu of the corpus callosum and the white substance of the frontal lobe and enter the internal capsule at the level of the middle part of the optic thalamus. This view also is dismissed by Dejerine. According to Wernicke the fasciculus measures a centimetre and a half in thickness. Neither the sections of Dejerine nor my dissections bear this out. Dejerine describes it as half a centimetre, and, although there were differences in size in the various dissections, that seems to be a sufficiently accurate estimate for the average.

In a naked eye dissection of such a fasciculus as this no conclusion can be drawn as to its precise and ultimate connections; but its disposition, extent, /

extent, and termination in front and behind, would suggest, without further investigation, that it is a long association bundle such as Dejerine has shown it to be. The persistence of the longitudinal direction of its fibres is a bar to Meynert's view, and its continuation backwards as far as the tapetum would at any rate modify Wernicke's conception of its association with the internal capsule.

In regard to the mode of termination of the occipito frontal fasciculus posteriorly, dissection does not confirm Dejerine's description. Dejerine states that the occipito-frontal bundle spreads out to form the tapetum. Dissection shows that the tapetum and the occipito-frontal fasciculus, although their fibres are intermingled, are essentially separate and distinct entities, and that the tapetum is derived from the corpus callosum, as was formerly believed. The continuity of the tapetum with the splenium and the deeper part of the posterior end of the body of the corpus callosum can, by dissections both from the outer and the inner aspects of the hemisphere, be demonstrated in a manner which can leave little or no doubt; and it can be equally well seen that the occipito-frontal bundle merely joins it, as is stated /

stated and implied in the text books of Edinger, p. 342. (XX.) and Cunningham (XXI).

Dejerine's statement that the tapetum is the expanded posterior end of the occipito-frontal bundle is supported by, and indeed is largely based upon, two facts, the one observed in experimental pathology; the other, of a teratological nature.

The experimental evidence is this, that in Muratoff's (XXII) researches carried out on the dog, the occipito-frontal fasciculus (fasciculus subcallosus of Muratoff), and in particular, the tapetum, remains intact after section of the corpus callosum, if the cerebral cortex is not accidentally injured during the operation. This statement is hard to controvert. It is however, unconfirmed by the experiments of Ferrier and Turner (XIII) on the Macaque so far as the tapetum is related to the occipital horn. After section of the corpus callosum they found degeneration in the white matter on the outer wall of the occipital horn immediately outside the ependyma. Dejerine himself admits that callosal fibres probably take some part in the formation of the outer wall of the posterior horn: " ..... il semble donc résulter de ces faits, que le corps calleux prend une certaine part dans /

dans la constitution de la paroi externe de la corne occipitale, et cela est d'autant plus probable, que Cajal a montré que les fibres calleuses ne sont souvent que la branche de bifurcation interne des longues fibres d'association". (p 763). It is not clear how the latter sentence supports his argument unless it be assumed that these association branches which mingle with the callosal fibres do not cross the middle line. Such an assumption would explain the absence of degeneration of tapetal fibres after section of the corpus callosum without implication of the fasciculus occipito-frontalis. At the best, the absence of degeneration of the tapetum after section of the corpus callosum means that its fibres do not cross the middle line. It does not prove its complete origin from the occipito-frontal bundle. The occipito-frontal bundle may contribute to the tapetum in a way which is not apparent in the dissection; for, although I am in ignorance of any evidence to this effect, it is possible that the depletion of the bundle as it passes backwards is, in part, due to fibres joining the body of the corpus callosum in which they pass backwards to its tapetum; but, even so, that would account for only a little more of the bulk of the tapetum in Man. Ferrier and /

and Turner do not make any statement as to the effect of section of the corpus callosum on that part of the tapetum covering the sphenoidal horn, and the absence of reference to it might be taken as negative evidence in support of Dejerine: for had degeneration been observed it is to be presumed that it would have been mentioned.

Clinical pathology as well as experimental ranges itself on the side of Dejerine who cites an instance in which Kaufman (XXIII) found the tapetum intact notwithstanding that there was almost complete softening of the corpus callosum.

Teratological evidence in support of Dejerine is found in the case of congenital absence of the corpus callosum. According to Dejerine it has been shown by Forel and Onufrowicz (XXIV) and confirmed by Kaufmann and Hochhaus, that in complete absence of the corpus callosum, its rostrum, genu, body and splenium are all undeveloped, as well as the forceps and the commissural fibres of the fornix, whereas the tapetum is well developed as in a normal brain. It is continuous in front with a sagittal bundle situated on the inner side of the corona radiata and external to the body of the fornix to which it is closely united. Forel and Onufrowicz named this bundle the occipito-frontal fasciculus /

fasciculus and identified it with the superior longitudinal fasciculus, and this was admitted by Kaufmann and Hochhaus; but Dejerine, justly, points out that the latter bundle lies on the outer side of the corona radiata, whereas the occipito-frontal lies on the inner side in relation to the lateral ventricle. He believes that it corresponds to the bundle bearing the same name which is observed in the normal hemisphere, dismissing as untenable the hypothesis of Sachs that the condition is not absence, but a "hétérotopie" in which the callosal fibres do not cross the middle line, but run in antero-posterior direction comfining themselves to one hemisphere.

Of the two testimonies - the experimental and the teratological - adduced in support of the view advocated by Dejerine, the experimental is the stronger. The case of the Macaque may be dismissed, for, in the absence of an explicit statement by Ferrier and Turner, the assumption that the sphenoidal part of the tapetum was unaffected is unwarranted. (I have been unable to obtain the original account of the case in which softening of the corpus callosum was unaccompanied by degeneration of the tapetum and cannot discuss its merits. The incomplete character of the softening may have left the tapetum untouched. /

untouched. Beevor in Trans. Roy. Soc. 1891, contributes a paper on the course of the posterior callosal fibres in the marmoset, which may throw some light on the subject, but the closing of the Library for annual inspection prevented access to it).

The results of Muratoff's experiments on the dog is the strongest argument against my belief in the continuity of the tapetum with the corpus callosum. The counter argument is a hypothetical subterfuge. A dissection on the brain of a dog might have supplied an adequate answer, but the opportunity and the time necessary to prepare and to dissect the brain of a dog have been wanting. The tapetum of a dog does not necessarily have the same constitution as that of a man. Dissection shows in the case of Man that the fibres of the occipito-frontal bundle mingle with those of the tapetum In the tapetum of a dog it is possible that the proportion of fibres derived from the occipito-frontal bundle, or other homolateral sources, is very much greater than it is in Man where callosal fibres preponderate, and the disproportion of the two systems may be so great that the callosal fibres (without imputing negligent observation) escape notice.

The /

The teratological evidence does not seem to me to carry so much weight; for the grave disarrangement which must result from absence of the corpus callosum introduces the probability that the so-called tapetum does not accurately correspond to that structure in the normal brain.

Dejerine suggests that the cingulum may be united to the occipito frontal bundle in the absence of the corpus callosum, but rejects the idea arising out of this suggestion that the cingulum constitutes the whole bundle, on the ground that it does not normally contribute to the formation of the outer walls of the occipital and sphenoidal horns of the ventricle.

Union between the cingulum and the occipito frontal bundle seems not only possible but inevitable in the absence of the normally intervening corpus callosum. In the illustration, given by Dejerine and taken from Forel and Onufrowiez, of a coronal section of a brain in which the corpus callosum was congenitally absent, the cingulum is not represented at all. The occipito-frontal fasciculus of Forel and Onufrowiez is represented as a very large structure which could include more than the combined cingulum and occipito-frontal fasciculus of Dejerine.

As /

As is described by Dejerine numerous fibres, after running for a certain distance as part of the cingulum of the normal brain, radiate from it to the convolutions on the mesial and tentorial aspect of the hemisphere. These radiating fibres can be displayed in an elementary dissection, arranged in laminae under the laminae of short association fibres. Those which radiate backwards into the posterior part of the brain lie at first in contact with the forceps major, which separates them from the ependyma and the cavity of the posterior horn. The fibres of the occipito-frontal bundle of Dejerine, as has been shown above, lose themselves by joining the tapetum and presumably spreading out on the outer wall of the ventricular horn; and there is no fundamental reason why the fibres composing the cingulum, already mingled with the occipito-frontal fibres owing to the elimination of the body of the corpus callosum, should not, in the associated absence of the splenium and forceps major, continue their intimate connection with this bundle, and, without neglecting to distribute the normal supply to the gyri on the inner aspect, take up a position on the outer wall of the ventricular horns, forming there a layer which resembles the tapetum of the corpus callosum.

The /

The chief objection to this proposition is that put forward by Dejerine, namely, that the cingulum does not normally supply the outer surface of the hemisphere. The presence of its fibres on the outer wall of the ventricular horns implies a distribution to that surface. But the withdrawal of the corpus callosum from the field leaves openings for many possibilities, and it is permissible to assume a quasi-compensatory supply of fibres from the same side of the brain, which run in company with the fibres of a bundle normally present, viz. the cingulum. This comes near the before-mentioned theory of Sachs. The hypothesis of Sachs is debatable. While Dejerine rejects it, it appears to be admitted by Edinger (p 343).

While Dejerine strengthens his case by reference to experiment, pathology and congenital deficiency, his argument is mainly grounded upon the study of sections of the normal brain.
The occipito-frontal bundle can be traced step by step in the coronal sections chosen to illustrate his work, but an examination of these does not justify his conclusions. The bundle is bulkiest in two sections which pass through the brain 55 m.m. and 60 m.m. behind the frontal pole. The latter section is taken immediately in front of the anterior commissure. Reference to the photograph will show that two such sections would pass /

pass through the thickest part of the occipito - frontal bundle exposed by dissection. The sections nearer the frontal pole than these two agree with my dissections in showing that the bundle becomes flattened and expanded as it approaches the genu. Tracing it backwards through successive sections the bundle, with occasional slight fluctuations, gradually and steadily diminishes in size, just as is shown in the dissection: until it becomes indistinguishable in the section which passes through the pulvinar at the level of the internal geniculate body, before any continuity with the tapetum is shown. A corresponding section would pass through the brain shown in the photograph, a little behind the figure 5, in front of the point where the occipito-frontal bundle comes into relation with the anterior edge of the tapetum.

Examination of his sections, therefore, would lead one to the conclusion that not only does the occipito-frontal fasciculus not form the tapetum, but also that it does not even contribute to form it. The latter however is explained by his previous affirmation that the bundle is broken up posteriorly.

Disparity in size of the occipito frontal bundle /

bundle and the tapetum is against the fact of their continuity, beyond the bundle being merely tributary to the tapetum. One glance at the dissection is sufficient to show that the tapetum exceeds the bundle many times in size even where the latter is thickest, and the inequality is most obvious in the situation where there should be conformity in size if the two structures were one in effect: that is where the fasciculus joins the tapetum. The disproportion between the two, so evident in the dissection, is borne out by examination of Dejerine's sections. The most attenuated part of the tapetum is its anterior and inferior projecting angle which is both narrow and very thin. As the sections go backwards, the tapetum appears not broader only, but much thicker, especially in its upper part, and very soon exceeds the occipito-frontal bundle in size, until in those sections which pass through the splenium its dimensions are such that it is inconceivable that more than an insignificant tithe of it could be derived from the fasciculus.

Apart from the striking inequality of size there is this further, that in studying figures 259, 260, 261, 262, there seems to be no point more clearly established than the continuity between /

between the tapetum and the corpus callosum. The work of Dejerine is so admirable and painstaking throughout that it seems strange that his written word should be at variance with his illustrations in regard to this point. I hesitate to run counter to the reasoning of so able an author and to audaciously employ his own material in support of my argument; but the conclusion I draw from a careful examination of the examples of sections selected for illustration is that they are at one with my dissections in upholding the old belief that the tapetum is part of the corpus callosum.

The form, position and relations of the fasciculus occipito frontalis are for the most part as they are described by Dejerine, but Dejerine is wrong in his statement that it spreads out to <u>form</u> the tapetum; for repeated dissections, made without bias, show that while its posterior fibres spread out and apparently mingle with those of the tapetum, its mode of junction with the tapetum, the obvious other source of the tapetum, and the insufficient size of the bundle, render untenable the belief that, of itself, it forms the tapetum. The fibres which compose the greater part of the tapetum, whatever their source may be, are, before forming the /

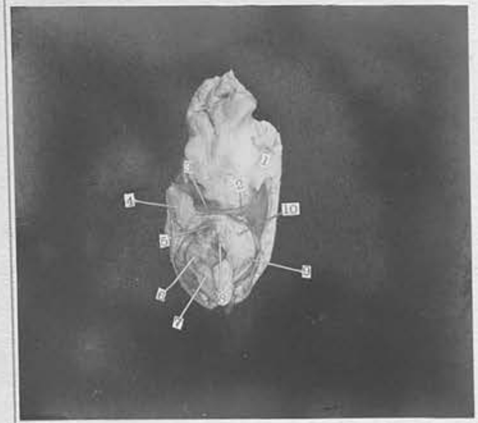
the tapetum, contained in the splenium and under part of the posterior end of the corpus callosum; and the tapetum is therefore to be justly regarded as one of the subdivisions of the corpus callosum. White callosal fibres preponderate in the tapetum, a certain small contribution is received from the occipito frontal fasciculus. This contribution is wholly insufficient to warrant the tapetum being described as an appendage of the fasciculus rather than of the corpus callosum.

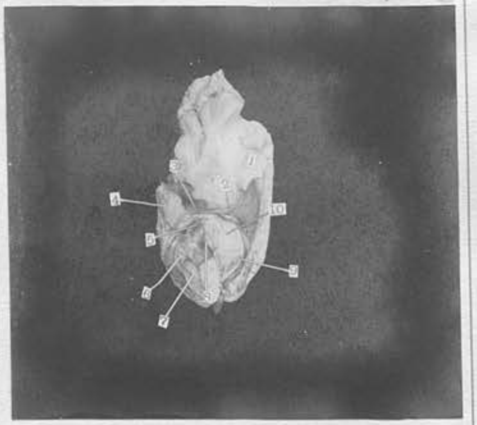
To return to the photograph: The object upon which the figure 7 is placed in photograph No. XIII. was, owing to the horizontal direction of its fibres, first mistaken for the internal medullary lamina, and nextly for the anterior peduncle of the optic thalamus. An extension of the dissection in another specimen, of which a photograph is here inserted, has shown it to be fibres of the inferior peduncle of the optic thalamus. The dissection was made on this piece of brain only experimentally, but time has been wanting to reproduce it in a better specimen. The parts may therefore be recognised only with difficulty. The piece of the brain comprises the basal ganglia and the island of Reil, the optic thalamus and the midbrain, /

PHOTOGRAPH N°O. XV.

A DISSECTION TO SHOW THE ANSA LENTICULARIS

1. Genu of corpus callosum.
2. Sub-callosal gyrus.
3. Ansa lenticularis.
4. Amygdaloid nucleus.
5. Substantia innominata
6. Crusta.
7. Tegmentum.
8. Corpus mammillare.
9. Taenia Thalami.
10. Inferior peduncle of optic thalamus.





midbrain, a part of the frontal lobe and the genu of the corpus callosum. The dark coloured field to the right is the caudate nucleus. The genu is numbered 1., the subcallosal gyrus 2, and it may be seen extending outwards as the diagonal band across the perforated space in front of the pin 3. The Amygdaloid nucleus is 4; and the pin of the figure 9 is inserted into the taenia thalami; 6 and 7, respectively, indicate the cut surfaces of the crusta and the tegmentum of the midbrain.

The optic tract has been taken away and the anterior pillar of the fornix was exposed to its termination in the corpus mamillare (8), and then removed. The bundle of Vicq d' Azyr has been uncovered to the point at which it passes under cover of the inferior peduncle. The gray matter of the inner side of the optic thalamus was removed to the level of the fibres of the inner peduncle - i.e. the fibres numbered 7 in No. XIII. Extending the dissection further forwards the anterior pillar of the fornix was met with and removed. The fibres of the uncovered lamina or peduncle at first horizontal, bend obliquely downwards and forwards and outwards. The change in direction takes place where the pin 10 is inserted. The tuber cinereum and the optic tract were next removed, and the lamina of fibres, forming /

forming now a bundle, was found to turn at a right angle opposite the anterior edge of the internal capsule. The gray matter of the posterior part of the anterior perforated spot was scraped away, and the band was traced across the perforated space towards the amygdaloid tubercle (4). In this part of its course it is numbered 3. Its position is above and in front of the optic tract.

On comparing the dissection with the sections in Dejerine, I have identified the white band (3) as the Ansa lenticularis, behind which is some more of the substantia innominata (5). The obliquely directed, flattened and triangular layer of fibres in front of the pin 10 is the inferior peduncle proper, and behind 10 this is mingled with other fibres in the thalamus.

PHOTOGRAPH NO. XVI.

A DISSECTION OF THE RIGHT CEREBRAL HEMISPHERE FROM THE MESIAL AND INFERIOR ASPECTS TO SHOW THE CORONA RADIATA, INTERNAL CAPSULE, THE CRUSTA, THE OCCIPITO-FRONTAL FASCICULUS, THE ANTERIOR COMMISSURE AND LENTICULAR NUCLEUS.

1. Corona Radiata
2. Optic radiation.
3. Temporo-thalamic tract.
4. Temporo-pontine tract.
5. Position of external geniculate body.
6. Internal geniculate body.
7. Deep surface of crusta.
8. Bed of optic thalamus.
9. Bed of caudate nucleus.
10. Occipito-frontal bundle.
11. Anterior commissure.
12. Cut surface of uncus.

The last stage in this series is :-

XVI. A DISSECTION OF THE RIGHT CEREBRAL HEMISPHERE FROM THE MESIAL AND INFERIOR ASPECTS SHOWING THE CORONA RADIATA, INTERNAL CAPSULE, THE CRUSTA, THE OCCIPITO-FRONTAL FASCICULUS, THE ANTERIOR COMMISSURE AND THE LENTICULAR NUCLEUS.

To expose the corona radiata with its occipital and temporal radiations there have been removed: (a) all the convolutions on the mesial aspect; (b) the hippocampal lingual and occipito-temporal convolutions on the tentorial aspect; (c) the corpus callosum including the tapetum; (d) the fornix; (e) the structures on the floor of the descending and posterior horns of the ventricle. The caudate nucleus has been taken away to expose the basal part or foot piece of the corona radiata at its junction with the internal capsule.

To expose the internal capsule the optic thalamus and the taenia semicircularis have been removed. The tegmentum and the substantia nigra have been dissected away to expose the deep surface of the crusta.

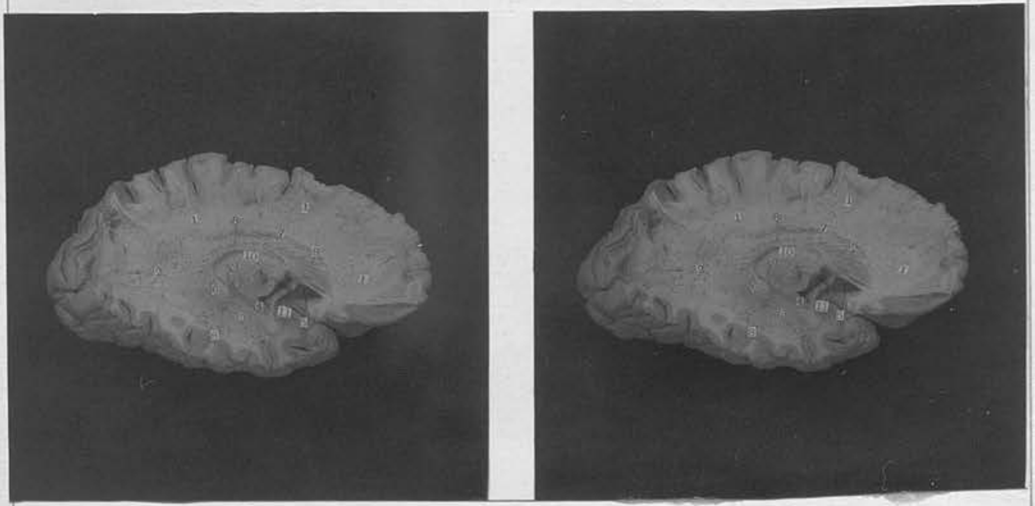
The anterior white commissure and the lenticular nucleus have been exposed by the removal of the amygdaloid nucleus and the anterior perforated spot.

In /

P H O T O G R A P H   N O. XVII.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE TO SHOW THE CORONA RADIATA, INTERNAL CAPSULE AND CRUSTA FROM THE INNER ASPECT.

1. Corona radiata.
2. Optic radiation.
3. Temporo-thalamic Tract.
4. Temporo-pontine Tract.
5. Lenticular nucleus.
6. External geniculate body.
7. Occipto-frontal fasciculus.
8. Bed of Caudate nucleus.
9. Bed of optic thalamus.
10. Deep surface of Crusta.
11. Anterior commissure.



In taking the photograph the same difficulty was met with as in the case of the tapetum and occipito frontal bundle - the difficulty of presenting all the structures exposed in one view; and it has been partly overcome by placing the brain with its anterior end upwards. Photographs of two specimens upon which the same dissection has been made are given. The second photograph No. XVII was taken from an experimental dissection carried out on an inferior specimen, and I have included it, as there are certain points better seen than in the photograph of the better preparation. The description however, does not apply to the second photograph except when special reference is made to it.

The appearance presented by the internal capsule and the corona radiata is unlike any that I had previously built up in imagination. They together somewhat resemble the leaf of some plants, or a wide, shallow cup or bowl, patterned and with a broad overlapping rim, of which the crusta is the stem. The appearance is better seen in the second photograph. The cup is broken in front, and to the outer side, opposite the fissure of Sylvius, and the gap is bridged across by the anterior commissure.

The /

The position of intersection of the corpus callosum with the corona radiata (1) can to some extent be made out as a darker coloured, broad strip, immediately above the occipito-frontal fasciculus (10) which is a further guide to its position.

The bed of the caudate nucleus (9) shows the impress of the nucleus, and shows also how the layer of fibres composing it is broken up into bundles by the lenticulo-caudate laminae. These laminae are seen to exist along almost the whole length of the bed of the nucleus, and to become less numerous, and the bundles of fibres consequently larger and coarser as they are followed along the course of the body and tail. The fibres which compose the bed of the caudate nucleus appear to be part of such as originate and terminate in the optic thalamus or pass through it, as may be seen by their abrupt termination along the margins of the area from which the optic thalamus has been removed. Along this margin lay the taenia semicircularis.

In front there is no deflection in the course of the fibres beyond the caudate nucleus, but at several points further back they bend at an angle of varying degree, as they pass towards the cortex. This can be best seen in the case of those which lie /

lie between the figure 10 and the uppermost figure 9. The bending in that situation seems to take place under the occipito-frontal bundle. It cannot, of course, be said that those fibres seen above the bundle are the same as those below it. They are, no doubt, mingled with fibres from the outer part of the internal capsule and from the corpus callosum, but there are some present, and these have been deflected in their course.

The alteration of the course of certain of the fibres extending from the external geniculate body is very well seen in the specimen although it is scarcely distinguishable in the photograph. They run outwards and forwards for some distance before turning backwards towards the occipital lobe. This is described by Dejerine. But a large tract of fibres from the external geniculate body (5) does not change its direction in this manner. It passes onwards, i.e. outwards and forwards, to the temporal lobe. This tract is indicated by the figure 3. (It is better seen in the second photograph No. XVII. in which the figure 3 is placed on this tract and the figure 6 on the position occupied by the external geniculate body). The fibres of this tract lie below, (i.e. nearer the cavity of the descending horn) the auditory fibres from the internal /

internal geniculate body, and the latter fibres are therefore concealed by them in the specimen except near their origin, and are not at all to be seen in the photograph where they are hidden by the crusta. The crusta keeps the internal geniculate body out of sight also, but its position is indicated by the pin supporting the figure 6.

Above this tract also are the temporo-pontine fibres. The direction of the temporo-pontine fibres is rather less obliquely forwards, and as they cross therefore at an acute angle they can be easily enough distinguished. The anterior or free edge of the temporo-pontine tract projects forwards beyond the most anterior fibres coming from the external geniculate body, and was covered for the most part by the amygdaloid nucleus. In both photographs it is indicated by the figure 4. The temporo pontine fibres join the crusta in such a manner that they can scarcely be said to have a share in the formation of the internal capsule, unless the term "sub-lenticular" part of the internal capsule, employed by Dejerine, be adopted.

The sheet or tract of fibres which pass between the external geniculate body and the temporal lobe appears to correspond to the fasciculus temporo-thalamicus /

thalamicus of Arnold which is described by Dejerine (XXV. p. 42) as a bundle which is spread out over the roof and anterior end of the descending horn underneath the fasciculus of Türck (Temporo-pontine) and converging upon the external geniculate body and the pulvinar, forms a compact fasciculus which crosses at a right angle under the retro lenticular part of the internal capsule. " -- faisceau qui passe au-dessous du faisceau de Türck et du segment retro-lenticulaire de la capsule interne qu'il croise à angle droit".

My specimen does not bear out this description fully. These fibres cross the temporo-pontine tract at an angle, but near the thalamus. They are parallel to the optic radiation fibres with which they form a continuous sheet. This is borne out by a later statement by Dejerine p. 68. "Les radiations du corps genouillé externe ...... concourent avec les radiations du pulvinar, et certaines fibres de la bandelette optique et du faisceau temporo-thalamique d'Arnold à la formation d'un champ compact de fibres". In the schematic representation of these fibres they do not seem to have the intimate connection with the external geniculate body which one would assume from the examination of the dissection. They differ also in /

in their relation to the fasciculus of Türck. In the schema, and implied in the text, the temporo thalamic fibres are placed far forwards extending to the anterior end of the ventricular horn, and in that respect correspond fairly closely to the dissection. But the fasciculus of Türck is placed over the middle of the horn, its anterior edge falling considerably short of the amygdaloid nucleus. In the photograph it can be seen that the temporo-pontine tract is situated so that its anterior edge is in front of that of the temporo-thalamic tract; and that these are temporo-pontine fibres there can be no doubt, for although the direct continuity with the outer part of crusta cannot be made out in the photograph, it can be well seen in the specimen; and the direction outwards is such that although they lie in front of the edge of the temporo-thalamic tract, yet its connection would not be too far forwards in the temporal lobe to be in discord with the current description of the tract.

The bed of the optic thalamus (8) is somewhat concavo-convex, and is smooth in contrast to the bed of the caudate nucleus. The fibrous or fasciculated nature of the internal capsule is not so marked in this region owing to the broken ends of /

of the multitudes of fibres which enter it from the optic thalamus. The bed is bounded above and in front and behind by the well defined edge formed by the broken ends of the fibres which pass between the thalamus and the cortex in relation to the caudate nucleus. Below, there is another edge composed of the ends of those fibres passing upwards from the tegmentum, which arising in (or passing through), the midbrain proceed into the internal capsule forming its innermost strata on the outer side of the optic thalamus without having traversed the latter structure, as shown in Dejerine Vol. I. figs. 250, 251.

The position of the external geniculate body (3) shows to what extent the optic thalamus extends outwards behind the internal capsule. The figure 7 is placed on the deep surface of the crusta.

The pin supporting the figure 10 is inserted into the anterior commissure. Above it is seen the bi-convex outline of the lenticular nucleus. Some of the under part of the nucleus has been taken away to more fully expose the commissure. In front of the commissure a small part of fasciculus uncinatus dimly appears arching round the Sylvian fissure. The relations of the commissure to the temporo pontine fibres, the lenticular nucleus and /

and the internal capsule are all conspicuous. With better effect from this aspect than from the outer surface can the coincidence of the genu which is produced by the bending of the internal capsule round the lenticular nucleus and the genu produced by the plunge forwards of the frontal fibres be observed.

DISSECTIONS OF THE CEREBRUM FROM BELOW.

These form a small group of three members which does not possess a serial character in the same sense as dissections from the other aspects of the cerebrum. The first is :-

XVIII. A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE TO SHOW CERTAIN PARTS OF THE RHINENCEPHALON. ON THE SAME SIDE THE FILLET HAS BEEN DISPLAYED IN THE MEDULLA AND PONS.

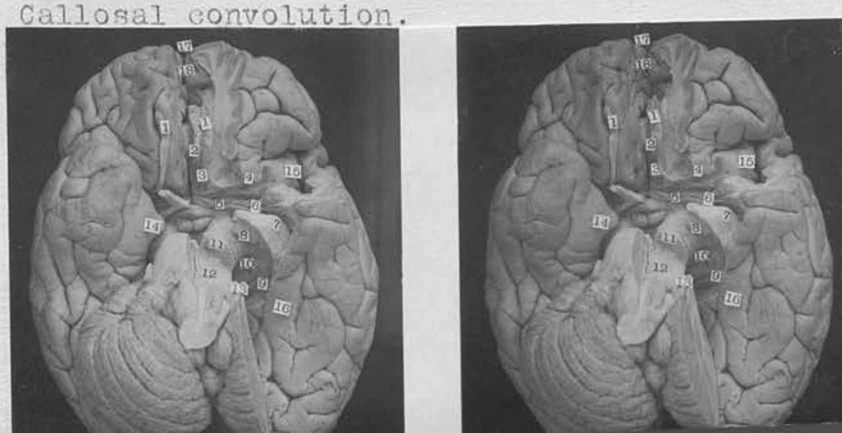
To expose the various parts of the Rhinencephalon, there have been removed: part of the hemisphere of the cerebellum; the hippocampal convolution and the temporal pole; some of the gray matter of the anterior perforated spot; the gyrus rectus and parts of the internal orbital, marginal and callosal convolutions. To expose the Fillet the ventral part of the pons and the pyramid of the medulla have been taken away.

The divisions of the rhinencephalon which can be seen from this point of view, with and without dissection are: The pyriform lobe (seen on the right hemisphere - 14); the olfactory bulb, tract, tubercle and roots (1, 3l and 4); the anterior perforated spot; the subcallosal gyrus (2), and its subdividion (5) which crosses the anterior perforated spot; the hippocampus major; the /

PHOTOGRAPH NO. XVIII.

A DISSECTION OF THE LEFT CEREBRAL HEMISPHERE FROM BELOW TO SHOW CERTAIN PARTS OF THE RHINENCEPHALON. ON THE SAME SIDE THE FILLET HAS BEEN EXPOSED IN MEDULLA AND PONS.

1. Olfactory bulb.
2. Sub-callosal gyrus.
3. Mesial root of Olfactory tract.
4. Lateral root of Olfactory tract.
5. Diagonal band.
6. Anterior commissure.
7. Hippocampus major.
8. Recurved extremity of uncus.
9. Gyrus dentatus.
10. Optic thalamus.
11. Crusta.
12. Fillet.
13. Eighth nerve.
14. Uncus.
15. Island of Reil.
16. Occipto-temporal convolution.
17. Marginal convolution.
18. Callosal convolution.



the gyrus dentatus (9); (and the anterior commissure).

The olfactory bulb and peduncle are sustained in what is more or less their normal position by a pin. The pyramidal form of the tuberculum olfactorium is well seen. The pins (rather indistinctly seen) which support the figures 3 and 4 are inserted into the mesial and lateral roots respectively. The mesial root, which is of some size, is seen running into the subcallosal gyrus (2) and not into the callosal convolution as is frequently described in text books, but in the removal of the callosal convolution and the gyrus rectus it was observed that there was a connection between their posterior extremities and the mesial root. Although the lateral root can be recognised as a distinct band in an undissected brain yet its isolation is difficult. As it is part of that aborted anterior end of the pyriform lobe of macrosmatic animals, its connection with the surrounding gray matter is very close, and in removing this to display the root more clearly one is apt to tear away the root itself. As a traceable structure it ends in the outer part of the anterior perforated spot. Although the assertion is still made in text books (XVII) it cannot be traced to the uncus in man.

The /

The subcallosal gyrus in this specimen is exceptionally large. In the dissecting room I have met with the subcallosal gyrus many times in the course of ordinary dissections, and in no instance have I found one of such dimensions as is seen here. It is usually a slender flattened strip of gray substance mixed with white, in comparison with which the gyrus in this specimen is voluminous. The relative ease with which this structure was isolated gave sufficient guarantee that its unusual bulk was not owing to incomplete removal of the adjacent callosal convolution. Its division into two parts is shown - one part joining the mesial root of the olfactory tract, the other passing across the perforated spot towards the temporal lobe.

The amygdaloid nucleus was removed with the uncus in order to show the anterior commissure, since, in virtue of its olfactory bundle, it has a place in the olfactory apparatus. It is seen bending down into the temporal lobe, and is indicated by the pin bearing the number 6. The essential part of it required here - the olfactory bundle - could not be found. In an "experimental" dissection carried out on a brain, soft and the worse for wear, to serve as a guide to the precise position of some of the structures approached from this aspect, I found what I took to be the olfactory bundle /

bundle - an exceedingly delicate fasciculus which differed from the description of the olfactory bundle in Dejerine in that it joined not the olfactory tubercle directly but the lateral root. In no subsequent dissection of the commissure have I been able to discover this bundle.

The anterior end of the hippocampus major (7) was exposed by the removal of the uncus. The recurved extremity of the uncus has been retained. The figure 8 lies on it, and immediately in front of the figure is the fraenulum of Giacomini.

The gyrus dentatus (9), whose furrowed under surface is shown, is at too great a depth to be conspicuous in the photograph and will be seen to better advantage in the next photograph which is merely a supplement to this. To the inner side of the gyrus dentatus is the outer part of the posterior end of the optic thalamus into which the pin 10 is inserted.

The fillet (12) has been traced from its decussation in the medulla to its entrance into the mid-brain. As two other dissections with the display of the fillet as their main object will be shown later little need be said here. It may be noted, however, that close to the midbrain a bundle of fibres crosses the middle line and joins the upper part of the other half of the pons. This appearance is /

is probably an exaggeration but on the many occasions on which I have made this dissection, fibres have always been found to cross to the opposite side more obliquely than the deep transverse fibres of the pons. These may be the fibres which Edinger described as crossing from the superficial pes lemniscus referred to later.

Portions of the spinal root of the fifth nerve and of Gowers tract are also shown in this dissection, but they will be dealt with later.

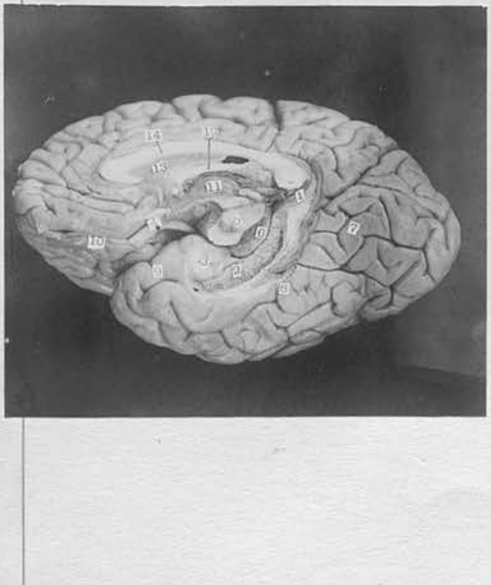
A supplementary dissection, No. XIX. to show the gyrus dentatus more clearly is appended. It was deemed inexpedient to carry out an extensive dissection on this hemisphere as all the features of the mesial surface are exceptionally well demonstrated. In separating the two hemispheres the knife was carried through the fifth ventricle. Only one lamina of the septum lucidum, therefore, is present, and it shows, in a very marked manner, the extent and dimensions of that structure in a brain hardened in situ.

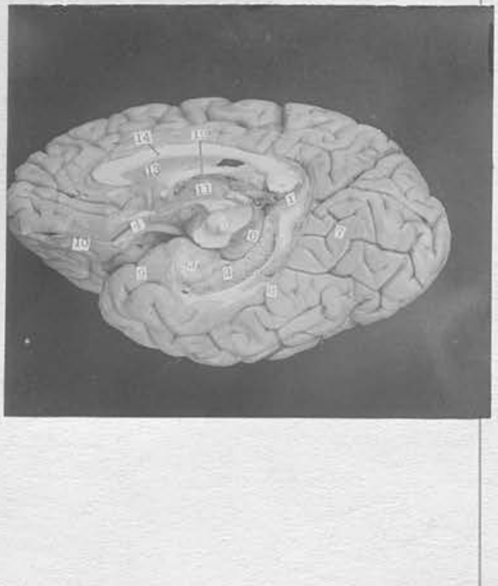
The hippocampal convolution and part of the occipito temporal convolution have been removed to expose the gyrus dentatus. The continuity between the gyrus dentatus (2) and the supracallosal gyrus (1) is well seen. The supracallosal gyrus is /

P H O T O G R A P H   N O. XIX.

A DISSECTION OF THE RIGHT CEREBRAL HEMISPHERE FROM BELOW TO SHOW THE GYRUS DENTATUS.

1. Supra-callosal gyrus.
2. Gyrus dentatus.
3. Uncus.
4. Optic chiasma.
5. Tegmentum.
6. Posterior end of optic thalamus.
7. Lingual convolution.
8. Occipto-temporal convolution.
9. Rhinal fissure.
10. Olfactory peduncle.
11. Mesial surface of optic thalamus.
12. Body of fornix.
13. Septum lucidum.
14. Corpus callosum.





is very well developed in this instance, and forms a longitudinal gray eminence placed on the upper surface of the splenium and posterior part of the body of the corpus callosum. Round the splenium it is seen bending to join the gyrus dentatus.

The next preparation is one which two dissections were made belonging to different regions, each of which has an equal claim on it. One of the dissections is, in some respects, a stage following that which deals with the rhinencephalon. The other should appear after the exposure of the fillet in the pons, and the photograph therefore fits in most conveniently after that which shows both rhinencephalon and fillet.

XX. A DISSECTION OF THE BRAIN FROM BELOW TO SHOW THE ANTERIOR WHITE COMMISSURE AND THE DECUSSATION OF THE SUPERIOR CEREBELLAR PEDUNCLES.

The temporal and occipital lobes have been removed in the first instance. To expose the anterior commissure there have been removed: (a) the optic nerves, chiasma, and part of the optic tracts; (b) the lamina cinerea, the anterior portion of the tuber cinereum and the anterior perforated spot; (c) the ependyma of the anterior part of the roof of the descending horn of the lateral ventricle with the structures lying above it, namely, the taenia semicircularis the tail of the caudate nucleus, the amygdaloid nucleus, the tapetum and the temporal fibres from the internal capsule. On the left side, the amygdaloid nucleus (2) and the taenia semicircularis (3) have been retained in order to show the relation of the commissure to the former structure. On /

P H O T O G R A P H   N O. XX.

A DISSECTION OF THE BRAIN FROM BELOW TO SHOW THE ANTERIOR Commissure and the Decussation OF THE SUPERIOR CEREBELLAR PEDUNCLES.

1. Anterior commissure.
2. Amygdaloid tubercle.
3. Taenia semicircularis.
4. Optic tract.
5. Tuber cinereum.
6. Internal capsule.
7. Crusta.
8. Red Nucleus.
9. Decussation of the Superior Cerebellar peduncles.
10. Superior Cerebellar peduncle.
11. Middle Cerebellar peduncle.
12. Inferior Cerebellar peduncle.
13. Pyramid of Medulla.

On the right side all the substance between the anterior commissure and the optic tract - ansae peduncularis et lenticularis and part of anterior perforated spot - have been taken away to expose the internal capsule (6 pin) and its relation to the commissure. A careful but unsuccessful attempt was made to find the olfactory bundle of the anterior commissure, but the course the bundle takes to reach the olfactory peduncle is clearly enough shown.

The form of a bow rather than a horse shoe is again presented.

To expose the superior cerebellar peduncles (10) and the inferior cerebellar peduncles (12) clean cuts were made through the pons at its junction with the middle peduncle, through the lower parts of the two crustae, and through the pyramids of the medulla, and the great part of the ventral division of the pons was removed in one piece. The remaining part of this division, and the tegmentum of the pons were removed piece-meal. The lateral fillet was dissected away from the outer surface of the superior peduncle.

The lower edge of the decussation (9) was exposed by this dissection, and to display it completely the lower part of the crusta of the midbrain and the substantia nigra have been removed. On the right /

right side some of the crossed peduncular fibres have been taken away to show the red nucleus (8).

The figure 13 is laid on the pyramid of the medulla. The upper ends of both pyramids have been taken away so that the ventral edges of the mesial fillet of both sides are seen. The middle peduncle is indicated by the figure 11 and the inferior peduncle is seen passing upwards, and then backwards between it and the superior peduncle. On the left side the cut was made to the inner side of the fifth and eighth nerves. On the right side the plane of the cut was external to these nerves and the inferior peduncle comes better into view and is numbered 12.

In the middle line the superior medullary velum is seen bulging into the cavity of the ventricle, and its appearance is detracted from by an accidental antero-posterior fissure. The darker coloured area on either side of it, posteriorly, is the inner surface of the peduncle in relation to the ventricle, from which the ependyma has not been removed. The more anterior part of the inner surface of the peduncle, exposed by removal of the adjacent reticular formation of the pons, is rougher and paler in colour, and its somewhat triangular outline is a good demonstration of the manner in which the superior peduncles sink into the tegmentum of the pons.

pons as they proceed onwards.

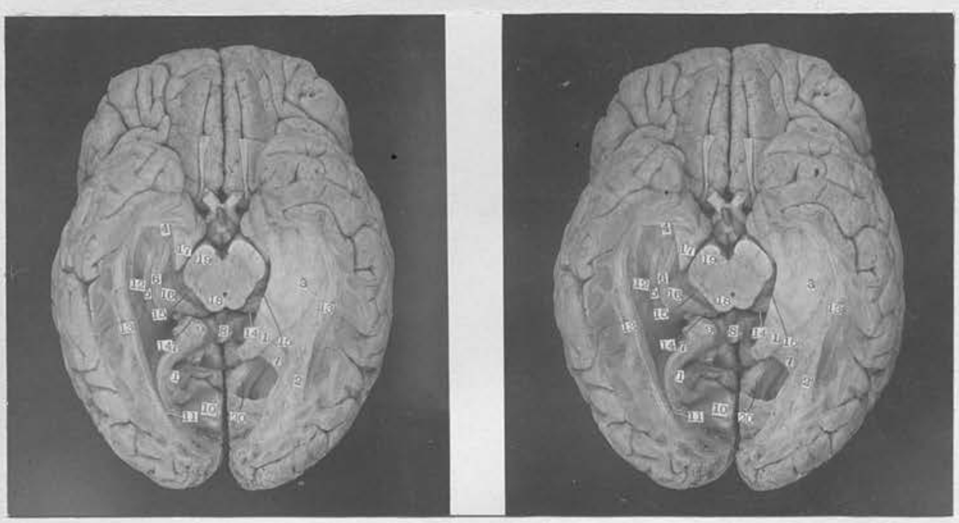
The meeting of the peduncular fibres in the middle line is very obvious, but the recognition of the actual decussation requires very close inspection, and is still more difficult after the specimen has been immersed in fluid. The difficulty arises from the fineness of the decussation which is one rather of fibres than of fasciculi. The commencement of the decussation is abrupt, and seems to be formed of the most ventral of the peduncular fibres. The re-formation of the peduncle after decussation is confused and difficult to demonstrate by dissection, but in some degree it has been made out on the right side from which a greater portion of the crusta (7) has been removed. Some of the crossed fibres have been taken away to show the red nucleus (8) and the manner in which the peduncle encapsules it.

During the process of the dissection there is a constant danger of the breaking of the narrow isthmus formed by the superior peduncles.

PHOTOGRAPH No. XXI.

A DISSECTION OF THE CEREBRUM FROM BELOW TO SHOW THE WHITE MATTER FORMING THE FLOORS OF THE POSTERIOR AND DESCENDING HORNS OF THE LATERAL VENTRICLE ON THE LEFT SIDE, AND THE ROOFS OF THESE HORNS ON THE RIGHT SIDE.

1. Posterior end of Cingulum (on the right side it is cut).
2. Occipital part of Inferior Longitudinal Bundle.
3. Cingulum in the Floor of Descending Horn.
4. Amygdaloid Tubercle.
5. Tail of Caudate Nucleus.
6. Taenia Semicircularis.
7. Forceps Major.
8. Splenium.
9. Supra-callosal Gyrus.
10. Upper wall of Calcarine Fissure.
11. Outer wall and Roof of Posterior Horn.
12. Outer wall of Descending Horn.
13. Inferior Longitudinal Fasciculus.
14. Pulvinar.
15. Internal Geniculate Body.
16. External Geniculate Body.
17. Uncus.
18. Superior Corpus Quadrigeminum.
19. Crusta.
20. White Core of Quadrate Lobule.



The last number of this group is :-

XXI. A DISSECTION OF THE CEREBRUM FROM BELOW TO SHOW THE WHITE MATTER FORMING THE FLOOR OF THE DESCENDING AND POSTERIOR HORNS OF THE LATERAL VENTRICLE ON THE LEFT SIDE, AND THE ROOFS OF THESE HORNS ON THE RIGHT SIDE.

On the left side the gray matter of the inferior surfaces of the occipital and temporal lobes and of the hippocampal convolution has been removed exposing the posterior end of the cingulum and the white matter derived from the splenium which forms the floors of the ventricular cornua. On the right side the whole floor has been removed exposing the roofs and outer walls of the horns. The ependyma covering the tail of the caudate nucleus and the taenia semicircularis has been taken away.

The cingulum on the right side has been cut short as it turned round the splenium and the pin 1 is inserted into the stump. On the left side it is seen spreading out and extending forwards in the hippocampal lobe to the uncus and beyond it to the temporal pole (1 and 3).

The forceps major is seen on both sides (7). On the right side those fibres which are derived from the most anterior part of the recurved portion of the splenium have been cut away, since they spread /

spread out into the floors of the ventricle, as may be seen on the left side. The fibres which are seen by the outer edge of the cingulum in the posterior part of the floor of the descending horn are derived from the splenium. This was pointed out under photograph No. XI. Extending backwards from the lowest and most anterior part of the splenium is the lower or accessory forceps major. Between it and the forceps major proper (7) is the cleft of the calcarine fissure. It lies in the floor of the posterior horn and its fibres are lost amongst those of the occipital part of the inferior longitudinal bundle. Upon this part of the inferior longitudinal bundle the figure 2 is placed.

The Inferior longitudinal bundle (13) is well displayed especially on the right side. The part shown is its thickened lower edge which Dejerine described as been folded inwards so as to form a gutter in which occipital and temporal projection fibres lie, and one can see how it projects inwards under the cavity of the ventricular horns. The lower edge of the bundle is the most conspicuous, and is believed by Dejerine to be mainly association in function. There is a growing belief that the inferior longitudinal bundle belongs to the projection system and that its posterior part is made up wholly of the central optic tract (XXVI.) It is /

is obviously and inevitably largely mixed up with occipital and temporal projection fibres, and commissural fibres besides. If its posterior part be wholly made up of the central optic tract, that would explain the absence of the inferior longitudinal bundle in relation to the posterior horn of the Macaque. But bundles of fibres can be pulled away, and like those of other long association tracts show no tendency to seek inwards to the central paths of projection fibres. If it be mainly a projection system it is, in its disposition, and in the manner in which its dissectable bundles run, singularly unlike any other part of that system.

The taenia semicircularis and the tail of the caudate nucleus are numbered 5 and 6, and are seen proceeding forwards in the roof of the descending horn to the amygdaloid tubercle (4) which in this case is rather poorly marked.

The dissection is not one of great difficulty. The exposure of the roof and outer wall of the horns is easy and the greater part can be effected by the knife; but the removal of ependyma from the structures in the roof requires care as they are apt to be pulled away with the ependyma. The retention of the white matter in the floors is a matter of difficulty and the thin layer derived from the splenium /

splenium is very liable to be taken away by accident.

DISSECTIONS OF THE HIPPOCAMPUS MAJOR.

The series devoted to the hippocampus major comprises ten specimens (five photographs) with a supplement of five specimens in addition, to illustrate certain points. (two photographs). The hippocampus major was the last structure to which I directed attention.

The portion of the brain containing the floors of the descending and posterior horns has in each case been cut away from the rest; and layer after layer of the hippocampus major has been removed until it was completely dissected away. In each case the exposure of the deeper layers was preceded by the removal, one by one, of the superficial layers, as confirmatory tests.

Without taking into consideration the layers as distinguished by microscopical examination, I have found, at least, eight layers in this dissection. That is to say, since the hippocampus has been produced by folding, that the two portions of the gyrus dentatus can be distinguished, and on each side of it, three layers of the hippocampus major proper.

In this region I found that the older the specimen /

P H O T O G R A P H N O. XXII.

HIPPOCAMPUS MAJOR - FIRST STAGE.

1. Splenium.

2. Posterior pillar of fornix.

3. Fimbria.

4. Gyrus dentatus.

5. Pes hippocampi..

6. Uncus.

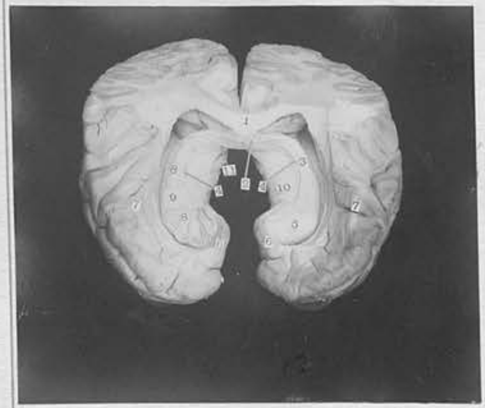
7. Upper surface of temporal lobe.

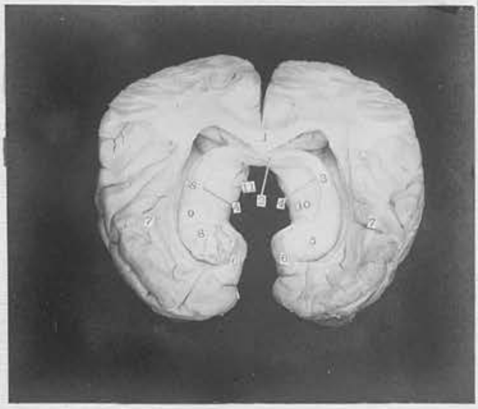
8. Gray layer under the alveus.

9. A band of the alveus retained.

10. Hippocampal convolution.

11. Junction of gyrus dentatus and supra-callosal gyrus.





specimen the easier was it to dissect. In an old brain the layers separate with the greatest readiness.

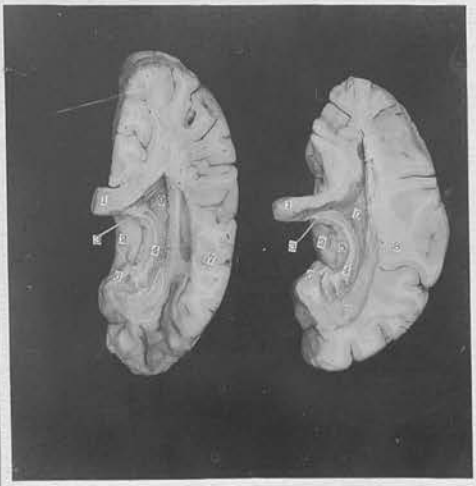
In the first two specimens the corpus callosum has not been divided - photograph No. XXII. The left hippocampus major has been left intact. On the right side the alveus and the fimbria have been removed, but a band of the alveus has been left to show its thickness (9). The brain was comparatively fresh so that some of the gray layer (8) of the posterior part of the hippocampus came away with the alveus, and the subjacent white layer is seen through it. In the region of the pes the white matter of the alveus was removed without much disturbance of the underlying gray layer. The pes on the right side was precisely like that on the left, but the digitations are better marked after removal of the alveus.

From the left hand specimen shown in photograph No. XXIII. the alveus and the subjacent gray layer have been taken away. This has also been done in the right hand specimen, and, in addition, the whole of /

P H O T O G R A P H N O. XXIII.

HIPPOCAMPUS MAJOR - SECOND STAGE.

1. Splenium.
2. Hippocampal convolution
3. Junction of dentate and supra-callosal gyri
4. "Whitish core".
5. Bed of gyrus dentatus.
6. Uncus.
7. Cut surface of upper temporal convolution.
8. Cut surface of middle temporal convolution.
9. Trigonum ventriculi.



of the gyrus dentatus has been removed.

The figure 4 is laid upon a "whitish core" of the hippocampus major which is exposed by the removal of the gray matter under the alveus. This core seems to be largely composed of white fibres. The more superficial of these are longitudinal in direction over the posterior part of the core, while near the pes they run obliquely from within outwards and forwards. The deeper fibres are transverse. The core is narrow and pointed at its posterior end, but anteriorly it is swollen, and is marked by salient ridges and broad depressions, corresponding to the degree of digitation of the pes hippocampi. These ridges are in some cases continued backwards along its outer border, diminishing in prominence and in the extent to which they encroach upon the superficial aspect. Following the course of the hippocampus, the anterior end of the core turns inwards, but it does not reach the most anterior part of the pes, and its inward curve is more abrupt.

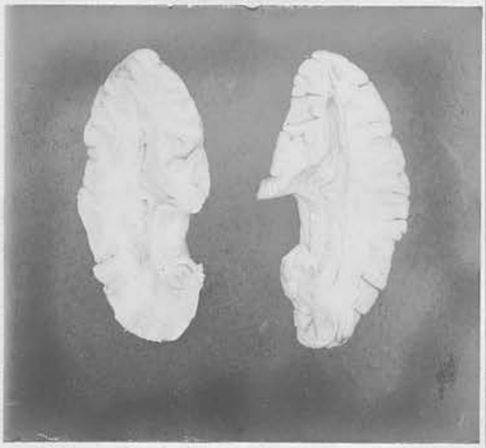
The pin of the figure 3 indicates the position of the junction of the gyrus dentatus, and the narrow gray strip which continues the supracallosal gyrus round the splenium of the corpus callosum. With this gray strip not only is the gyrus dentatus continuous, but also the "whitish core" and the gray matter under

the /

PHOTOGRAPH NO. XXIV.

HIPPOCAMPUS MAJOR - SUPPLEMENTARY SPECIMENS OF SECOND STAGE.

1. Splenium.
2. Free edge gyrus dentatus.
3. "Whitish core".
4. Eminentia collateralis.
5. Uncus.



the alveus. This connection was new to me. It may be implied amidst the confusing terminology in which descriptions of this region abound, but I am unable to find an explicit statement to that effect in any of the text books to which I have referred, including Dejerine and Obersteiner, who treat the subject of the hippocampal region at some length.

From the right hand specimen the gyrus dentatus has been removed. The figure 5 is laid upon its bed. The apparent breach of continuity between this bed and the exposed upper surface of the hippocampal convolution is a colour effect, and not real. The layer upon which the figure 5 is laid is continuous with the "whitish core" (4) round a curve. The specimen has not been sufficiently tilted to show the concavity between the layers 4 and 5. In the concavity reposed the curled outer edge of the gyrus dentatus ensheathed by the layers 4 and 5.

In further illustration of the whitish core, another photograph No. XXIV. is introduced, showing preliminary dissections on outworn pieces of brain. They exemplify variations of breadth and of degrees of ridging. That in the left hand specimen is the broadest I have found in any case. The specimen on the right hand side exhibits a higher degree of digitation. /

digitation. There are three ridges in front of the figure 3, two opposite the figure and two smaller ones behind it. As the ridges are followed backwards they become smaller and do not project so as to be seen well from above, and they also creep further on to the inferior surface.

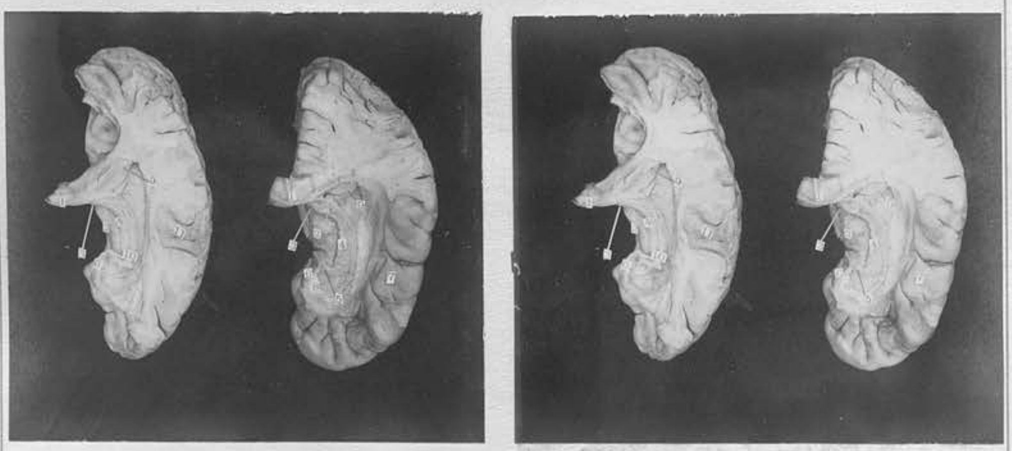
In the next photograph No. XXV. two succeeding stages are shown.

In the left hand specimen the "whitish core" has been removed, disclosing a gray body (10) which conforms to, and determines, the shape of the "whitish core". It is narrow and pointed posteriorly and its swollen anterior extremity is marked by ridges in the same manner as the overlying white, and, indeed, upon these depend the amount of digitation of the pes hippocampi. The inward bend of the anterior end is very sudden, the bent portion being placed at a right angle to the rest of the body. The "whitish core" separates from it much more easily than the subalvear gray layer from the white core, in a specimen which is not very old. The "gray body", by its deeper parts, is continuous internally with the free projecting part of the gyrus dentatus. Superficially they are separated /

PHOTOGRAPH NO. XXV.

HIPPOCAMPUS MAJOR - THIRD AND FOURTH STAGES.

1. Splenium.
2. Hippocampal convolution.
3. Junction of supra-callosal and dentate gyri.
4. Free edge of gyrus dentatus.
5. Commencement of fraenulum of Giacomini.
6. Uncus.
7. Upper surface of temporal lobe.
8. Anterior extremity of pes hippocampi.
9. Hippocampus minor.
10. "Gray body", or enclosed part of gyrus dentatus.
11. Upper surface of middle temporal convolution.



separated along a narrow interval by entering bloodvessels and by white matter connected with the fimbria and alveus.

From the specimen on the right hand side this gray body has been removed, and its continuity with the dentate fascia (4) was only made out in the process of doing so. Its incurved anterior extremity was also continuous with, or connected to, the fraenulum of Giacomini (5). The portion of this band which lies on the free surface of the uncus can be distinguished near the tip of the uncus. The distance of the "gray body" and of the fraenulum of Giacomini from the extremity of the pes may be noted. In the left hand specimen the cut edge of the alveus indicates the position of the extremity, and on it, in the right hand specimen, the figure 8 is laid.

The band (5) named above the "commencement of the fraenulum of Giacomini", comprises more than the fraenulum as seen from the under surface; but the fraenulum is so slender that is was not safe to isolate it completely.

From the left hand specimen shown in the next photograph - No. XXVI, the previous steps having been /

PHOTOGRAPH NO. XXVI.

HIPPOCAMPUS MAJOR - FIFTH AND SIXTH STAGES.

1. Splenium.
2. Hippocampal convolution.
3. Junction of supracallosal gyrus and dentate gyrus.
4. Deepest gray layer of Hippocampus major.
5. "Subdentate layer" or bed of gyrus dentatus in left hand specimen.
5. Collateral eminence in right hand specimen.
6. Recurved extremity of uncus.
7. Upper surface of temporal lobe.
8. Cut surface of upper temporal convolution.
9. Uncus.

been repeated, the fascia dentata was removed from its bed (5). (The figure 5 has, unfortunately, been reduplicated. In the right hand specimen it is laid upon the collateral eminence, not upon the bed of the gyrus dentatus). This bed is directly continuous internally with the surface layer of the hippocampal convolution (2). Externally it turns upwards, round the outer side of the "gray body" to become continuous with the "whitish core", as was implied under another photograph - No. XXIV. Its surface in relation to the gyrus dentatus in finely corrugated, and is composed of transverse fibres, mainly, continuous with the transverse, deep, fibres of the white core.

In the right hand specimen this layer underlying the gyrus dentatus has been taken away. Its deeper part seemed to contain more gray matter and fewer longitudinal fibres than the superficial strata of the "whitish core" with which it was continuous. This layer strips off very easily from that which underlies it (4). The underlying layer (4) is mainly composed of gray matter, so far as can be detected by the naked eye, and it is continuous with the first gray layer met with under the alveus.

The surface of this layer, exposed by the removal of the sub-dentate lamina is sometimes coarsely /

coarsely corrugated; but this character was conspicuous only in the specimen on which the dissection was first made. Althouth I wasted some material I was unable to find it nearly so well marked on any other specimen. In some cases the surface is almost smooth, like that which is shown in the photograph. When this surface is corrugated, the under surface of the subdentate layer is similarly embellished, the corrugations of the one interlocking with those of the other, and the outer margin of the "whitish core" is marked by ridges which are the outer ends of the rugae.

A supplementary photograph of three "experimental" dissections is introduced here - No. XXVII.

The upper left hand specimen is one in which the free edge of the gyrus dentatus was not in evidence before the removal of the fimbria, and the "gray body" (6) is correspondingly large. In all the specimens dissected, the size of the gray body varied inversely with the amount of the gyrus dentatus protruded beyond the edge of the fimbria. In this case even after the removal of the fimbria the edge of the gyrus dentatus is not prominent. In this specimen, also, the pes hippocampi was without superficial markings, and the anterior end of the "gray /

PHOTOGRAPH NO. XXVII.

HIPPOCAMPUS MAJOR. - SUPPLEMENTARY SPECIMENS OF THIRD, FIFTH AND SIXTH STAGES.

1. Splenium.
2. Subdentate layer.
3. Eminentia collateralis.
4. Deepest gray layer of hippocampus major.
5. Trigonum ventriculi.
6. "Gray body" or concealed part of gyrus dentatus.
7. Anterior end of pes hippocampi.
8. Supracallosal gyrus.


"gray body", therefore, shows but one ridge which gives it the appearance of possessing a pointed anterior extremity. The in-turned portion is a flattened band, curved with the concavity upwards, of which the fraenulum of Giacomini forms the anterior edge.

The right hand upper specimen merely shows the surface of the subdentate layer on which the fine corrugations are better marked and might almost be termed "coarse". They are probably reflections of the coarser corrugations underneath.

The lower specimen is that on which the dissection was first carried to the stage which involves the removal of the subdentate layer as the final step. The coarse corrugations are well marked. They are narrower and closer set, behind, broader and further apart in the middle, and absent in front. They number nine in all.

The figure 5 is placed on the trigonum ventriculi. The radiating fibres internal to it come from the splenium of the corpus callosum. This point was discussed under photographs XI. and XXI.

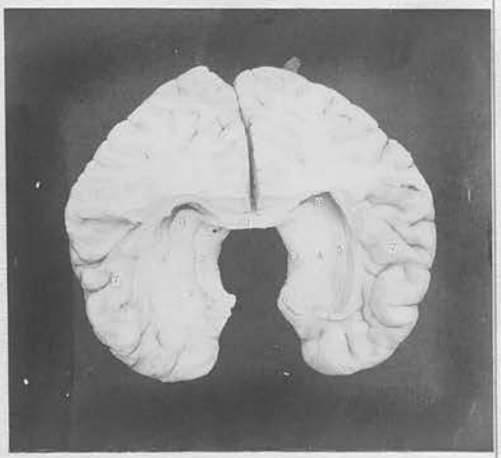
The seventh and last photograph No. XXVIII. of this series shows the last two stages.

On /

P H O T O G R A P H   N O. XXVIII.

HIPPOCAMPUS MAJOR. - SEVENTH AND EIGHTH STAGES.

1. Splenium.
2. Hippocampal convolution.
3. Deep part of alveus .
4. Bed of Hippocampus major.
5. Eminentia Collateralis.
6. Uncus.
7. Upper surface of temporal lobe.
8. Trigonum ventriculi.



On the left hand side of the specimen, (i.e. on the right side of the hemisphere), the coarsely corrugated layer has been scraped away from the portion of the alveus (3) which covers the under aspect of the hippocampus major. As stated before this layer is continuous with the gray layer shown in the first photograph of this series.

From the right hand side of the specimen, this portion of the alveus has been cut away, that is to say, the whole hippocampus major has been removed, and its bed (4) is exposed.

These two stages do not require further attention.

It has not been altogether easy to identify these various layers with those described in the text books from a histological standpoint; and so great a number of strata, visible to the naked eye, has not to my knowledge been hitherto described, although a near approach is made in two papers which will be referred to later.

As appears from the illustrations in Dejerine, Obersteiner, and Schäfer's Essentials of Histology, the gyrus dentatus is a band whose edges curl upwards towards one another, but do not meet, so that a longitudinal slit or hilum is left through which the substance of the hippocampus major projects /

projects into the space enclosed by the gyrus dentatus. This arrangement is described by Dejerine who likens the gyrus dentatus, on cross section, to a purse. The inner part of the gyrus is flattened from above downwards, and is the portion which is ordinarily seen partly under cover of, and partly protruding as a notched edge beyond, the fimbria. The part external to the slit or hilum is hidden within the hippocampus, and is more rounded than the other. The "gray body" which I have exposed is the hidden outer part of the gyrus dentatus, though its appearance and shape do not lead one at first to recognise it as such. But in its removal it was found to be continuous with the grooved and flattened unconcealed part of the gyrus dentatus. The linear interval along the inner side of the gray body is the hilum in which the blood vessels and the substance connecting it with the fimbria and the hippocampus were found. Its size depends upon the degree of protrusion of the gyrus dentatus beyond the fimbria.

The "whitish core" and the "subdentate layer" form one continuous curved sheet which enclosed the outer part of the gyrus dentatus. I had more difficulty in identifying this sheet. It consists of at least two curved layers. Employing Obersteiner's nomenclature, the layer in contact with the gyrus /

gyrus dentatus is the lamina medullaris interna, the other, more superficial layer is the Stratum medullare medium.

According to Obersteiner, the lamina medullaris externa of the subiculum, as it enters the hippocampus major, divides into two. The more superficial one, i.e. the one nearer the gyrus dentatus is the lamina medullaris interna (nuclear layer; lamina medullaris involuta). "Its fibres run in the plane of the section when cut transversely". This lamina, then, corresponds to the superficial stratum of the "subdentate layer", where the fibres are seen to be transverse, and to the transverse deeper fibres of the "whitish core". "The other layer derived from the lamina medullaris externa of the subiculum is also rich in medullated fibres (stratum medullare medium). It lies parallel to the nuclear layer, but its nerve fibres run, for the most part, obliquely or longitudinally". This lamina corresponds to the deeper stratum of the "subdentate layer" (in which, however, not many fibres were to be distinguished), and the superior layers of the "whitish core" which were composed of longitudinal and oblique fibres.

The layer of gray matter first met with under the alveus, and the corrugated layer last encountered are continuous with one another round the convex /

convex outer margin of the hippocampus. They form therefore one lamina which, with the alveus, is composed of all the other layers described histologically.

Recent literature dealing with the naked eye anatomy of the hippocampus major had escaped my attention, but when the dissections were completed and the layers indentified, my colleague, Dr. Waterston, referred me to two papers which had lately appeared.

In 1898, Dr: J. G. M'Carthy of Montreal, described before the British Medical Association in Edinburgh, a new dissection showing the internal gross anotomy of the hippocampus major (XXVII). Forty brains had been examined by him. An incision was made along the convex margin of the hippocampus. The superficial strata were separated, along a line of cleavage from the "core" which presented along its convexity toothed processes interdigitating with similar processes in adjacent gray matter. These varied in number and prominence and were in some cases absent. Similar variations in my specimens I have referred to above. He also found in a well notched pes ridges on the anterior aspect of the "core", and his dissections were in further accord with mine in the respect that this

this /

this "core" "had its origin in a narrow band of gray matter in conjunction with the gyrus dentatus, in close proximity to the splenium corporis callosi".

As this "core" was met with when the superficial white and gray matter of the hippocampus is removed, and since it shows ridges and grooves in its border, it is identical with the "whitish core" exposed in my dissections. Dr. Waterston has in his possession some of the original specimens which Dr. M'Carthy brought to this country, and when I examined them I found the "gray body" within the "core" when an incision was made in the core and the lips opened.

He refers to this core as "grey" and his attention does not seem to have been drawn to the visible presence of white fibres. In my specimens while there is obviously gray matter in this core, white appears to predominate and to give it a whitish appearance. It is possible that the line of cleavage is such that some of the superficial gray matter is left upon the white core, for in his account he refers to the possibility of seeing this line of cleavage, on transverse section, with the aid of a pocket lens. In the dissections on fresh specimens I did not find so distinct a line of cleavage separating the whitish core from the superficial gray matter and I may have passed it, as my mode of dissecting was different. In the dissections /

dissections on old specimens there is a distinct line of cleavage, and the distinction between gray and white matter is not sufficiently obvious in old specimens to enable me to be certain that the core uncovered in the old specimem is precisely identical with that in a fresh specimen; but although the distinction in colour was imperfect, the fibrous character of the core in the old specimen of brain was sufficiently manifest. His interpretation differs from mine in this that he identifies the "core" with the involuted medullary lamina, and not with the stratum medullare medium. He ascribes the formation of notches on the pes hippocampi to the elevations on the anterior end of the core, whereas both these and the digitate condition of the pes appear to have their ultimate determinant in the elevations on the swollen anterior extremity of the "gray body" - that is the ensheathed portion of the gyrus dentatus.

In 1904 Wiedersteim (XXVIII) contributed a note on the same subject, which is virtually the same as Dr. M'Carthy's. A split along the outer margin of the hippocampus disclosed a gray kernel on whose under surface there were nine or ten indentations, and when this core was turned inwards a similar arrangement was found underneath it. This kernel therefore was the "whitish core", else it would not have /

have shown indentations so numerous and so well marked. On two points my dissections lead me to differ from him. He described it as a gray kernel instead of white. In the first photograph of this series the white appearance of the core may even be seen through the remnant of gray matter covering it. Further, he describes it as being continuous with the gyrus dentatus internally whereas in one of the specimens shown in the second photograph the gyrus dentatus has been pulled out of the "kernel" which remains undisturbed.

With the dissections of the hippocampus major the series of dissections of the cerebrum come to a close.

A D E S C R I P T I O N

OF SEVERAL SERIES OF UNUSUAL DISSECTIONS OF

THE

H U M A N B R A I N .

VOL. II.

DISSECTIONS OF THE BRAIN-STEM AND CEREBELLUM.

Edward B. Jamieson, M.B., Ch.B.

1906.

The remaining dissections deal with the brain-stem and the cerebellum. They do not arrange themselves in definite series, but as far as possible they are made to follow one another in order. The first to be shown is one whose immediate precursor - the display of the pyramidal bundles - has been already included amongst those which exhibited the projection system of fibres from the outer side.

XXIX. TWO DISSECTIONS SHOWING THE FILLET.

Specimen A. shows the dorsal aspect of the fillet, and at the same time the posterior longitudinal fasciculus. Specimen B. shows the ventral surface of the fillet. The two specimens are examples of the two methods of preparing brains for dissection. Specimen A. is part of a brain hardened and preserved in formaldehyde only, and after removal from the body. Its appearance contrasts strongly with that of specimen B. which has been treated with arsenical preservative and formaldehyde in situ.

In Specimen A. the vermis and adjoining parts of the cerebellar hemisphere have been removed. Subsequently, on the right side the gray matter of the floor of the fourth ventricle, the inner portions of /

PHOTOGRAPH NO. XXIX.

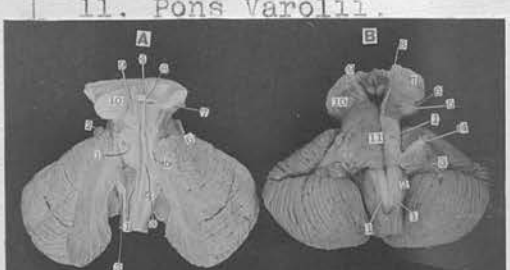
TWO DISSECTIONS SHOWING THE FILLET.

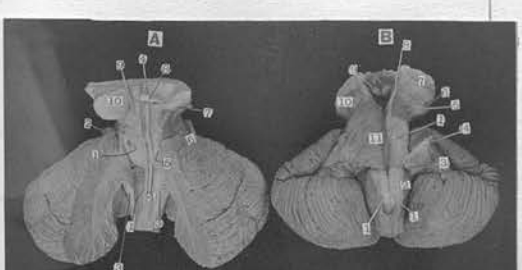
Specimen A.

1. Mesial fillet.
2. Lateral fillet.
3. Restiform body.
4. Posterior longitudinal bundle.
5. Superior cerebellar peduncle.
6. Inferior corpus quadrigeminum.
7. Internal geniculate body.
8. Posterior commissure.
9. Superior corpus quadrigeminum.
10. Pulvinar.

Specimen B.

1. Mesial fillet.
2. Olive.
3. Seventh cranial nerve.
4. Fifth cranial nerve.
5. Substantia nigra.
6. Internal geniculate body.
7. Junction of crusta and internal capsula.
8. Fillet fibres joining the crusta.
9. Corpus mammillare.
10. Crusta.
11. Pons Varolii.





of the corpora quadrigemina and the Sylvian gray matter have been taken away, exposing the posterior longitudinal bundle in the medulla pons and mid-brain; and its cephalic extremity has been traced into the side wall of the third ventricle. It is into the last part of its course that the uppermost of the pins bearing the figure 4 is placed.

Both in connection with the posterior longitudinal bundle and with the fillet, the difficulty, met with in several of the formaline hardened brains, was to distinguish the fibreing of the tracts; but sufficient guidance was given by a preliminary dissection on a soft brain in which the distinction between gray and white matter was very clear and the fibreing very obvious, but whose softness rendered it unsuitable for preservation.

On the right side, also, the posterior white commissure (8) has been traced outwards some distance.

On the left side, the dorsal division of the pons, including the superior cerebellar peduncle, the formatio grisea of the medulla, as well as the bulbar part of the floor of the fourth ventricle and the posterior longitudinal bundle, have been dissected away to expose the dorsal surface of the mesial fillet (1). In the removal of the superior cerebellar peduncle care was taken to retain the lateral /

lateral fillet (2).

A dissection of the fillet from this point of view is necessary as complementary to the dissection from the ventral aspect. It shows the change in the direction of the surfaces of the fillet from latero-mesial in the medulla to dorso-ventral in the pons, and the continuity of the dorsal edge of the medullary part with the mesial or inner margin in the pons. The relations of the lateral and mesial fillets, their naked eye continuity, and the angle which they form, are seen from this point of view.

The restiform body is marked by the figure 3. The dark coloured material seen in the deep hollow in front and to its inner side is part of the inferior olivary nucleus.

In the right hand specimen (B) the crusta of the midbrain has been removed to expose the substantia ingra (5), the irregularities of whose surface is well seen in the actual specimen though they are not clearly brought out in the photograph. The ventral division of the pons has been dissected away to expose the ventral surface of the mesial fillet in the pons. The pyramids of the medulla have been lifted off to show the ventral edges of both mesial fillets and their decussation.

A /

A small band (8) which lay along the inner side of the crusta, and formed part of it, has been left, and it is seen to be continuous below with the innermost part of the fillet. Traced downwards it gradually diminishes in size and ends about half way down the pons. Traced upwards it broadened out and encroached upon the outer surface of the crusta, but only part of it has been retained.

This corresponds to the bundles described by Obersteiner (XIV. figs. 132, 133, 134) which, separating from the mesial fillet, place themselves on the mesial side of the pes pedunculi, and, spreading out sideways, curve round the outer side of the crusta as far as its lateral border where (fig. 141) it occupies a deep position. This description does not wholly agree with any of my dissections of this region. I have not found fibres of this bundle extending so far as the lateral border of the crusta. This bundle has borne several names enumerated by Dejerine and to them he adds another (Vol. II. part 1. p.570): "pes lemniscus superficiel", in contra-distinction to a deeper group of fibres connecting the pes pedunculi and the fillet: "pes lemniscus profrond". The deep pes is constant and concerning it he writes, p. 543 - "Le /

"Le pes leminscus profond se détache de la face profond du deuxiéme cinquiéme externe du pied du pédoncule cérébral, traverse obliquement le locus niger et s'accole au ruban de Reil médian au-dessus on au niveau du sillon pédonculo-protubér-iantiel ..... "

Of the superficial he writes, p.52: "Au lieu d'être profondes, ces fibres aberrantes peuvent être quelquefois superficielles. On les voit alors se détacher du deuxiéme cinquiéme externe du pied du pédoncule, se diriger obliquement en bas et en dedans, croiser la face libre du pied du pédoncule cérébral en formant le faisceau en écharpe de féré. Au niveau du sillon pédonculo-protub-érantiel elles atteignent le bord interne du pied du pédoncule et se placent en dedans de son faisceau interne; dans la protubérance elles sont refoulées en arriére par les fibres transversales de la pro-tubérance et s'accolent à la partie interne du ruban de Reil médian ..... Le pes lemniscus profond est constant, le superficiel est relativement rare, et il semble exister une vicariance entre ces deux faisceaux aberrants de la voie pédonculaire".

This superficial pes agrees with the bundle described in Obersteiner, except that superiorly it does not attain the lateral border of the crusta. Those fibres /

fibres found in relation to the lateral border are accounted for under another name, pp. 53-54: "parfois on voit se détacher du 2e cinquième externe de la voie pédonculaire des fibres aberrantes superficielles, qui à l'encontre du pes lemniscus superficiel se portent en haut, en arrière et en dehors; elles contournent le faisceau externe du pied du pédoncule cérébral, puis s'infléchissent en dedaus au voisinage de la region sous-optique, passent en avant du corps genouillé interne et se dirigent vers le tubercule quadrijumeau anterieur. Ces fibres aberrantes postéro-externes suivent en quelque sorte le trajet du tractus pedoncularis transversus de Gudden".

The description of the superficial pes by Dejerine compares very closely with what I have found in dissection, but the relative rarity to which he refers has not been observed so much as inconstancy in size. I cannot answer for its presence in earlier dissections, but of late I have frequently exposed the fillet while aiding students in the dissecting room, and this bundle has been almost always found. With its variability in size there is associated a variability in its junction with (or detachment from) the crusta. The bundle, when /

when small, frequently disappears under cover of the optic tract on the inner side of a line bisecting the crusta longitudinally. The fibres, no doubt, join what corresponds to the "deuxième cinquième externe" above that level. One would gather from the descriptions of Dejerine and Obersteiner that this bundle forms a distinct outstanding band on the surface of the crusta, whereas the fibres are spread out and appear to be incorporated as an integral part of the crusta, and distinguishable only by their obliquity. Dejerine holds out a warning (p. 56) that the taenia pontis in the absence of the pes superficiel may be mistaken for the pes superficiel in transverse sections, but in a naked eye examination of an untouched brain there is no possibility of confusion owing to the low position and the direction of the taenia pontis, which is usually also paler in colour than the crusta upon which it lies.

Unlike the pyramidal bundles which should be dissected from above downwards, the fillet is most readily followed from the medulla upwards. In the medulla its exposure is brought about by merely lifting off the pyramid.

The decussation of the fillets, like that of the superior cerebellar peduncles, is, owing to /

to its fineness, difficult to see without close inspection. The position of the decussation of the fillets, relative to that of the pyramids, is not the same in all cases, not on account of inconstancy of the level at which the deep arcuate fibres cross, but to shifting of the point at which the pyramaids begin to decussate. In the dissection of which the photograph is given, the decussation of the fillets is exposed down to its lowest limits, and to do so a considerable portion of the pyramidal decussation had to be taken away.

The depth at which the fillet lies in the pons (viewed from the ventral aspect: this point is better shown in the photograph of the rhinencephalon and fillet) is so great that, if the dissection be begun by removal of portions of the ventral division of the pons, one may be led astray by coming upon broad flattened pyramidal bundles at a depth which seems to meet the requirements of the position of the fillet as judged from cross section (for at this stage the thickness of the dorsal remainder cannot be estimated with accuracy). The bend which the fillet makes as it passes from the medulla and, broadening out, takes up its deep position in the pons is so considerable as to be sometimes disconcerting /

disconcerting in a dissection. There is a more gradual inclination forwards as it passes into the midbrain. The result of these bends is that the ventral surface is concave from above downwards.

The exposure of the fillet is however relatively easy, depending upon the fact that the fibres in relation to its ventral surface run transversely, and the admixture of fillet fibres with transverse fibres seen on section (e.g. corpus trapezoides) is not sufficient to cause trouble. There are occasions when the deeper pyramidal bundles, which vary very greatly in their size and form, closely simulate the fillet and one should therefore not be satisfied until the oblique continuity with the lateral fillet at the side is demonstrated. By the absence of grave difficulty it is meant that not a very long time would be taken up for the rough exposure of the fillet, sufficient to show that such a tract exists to the naked eye, and to give a general idea of its appearance and position. The cleaning of its surface, the trimming and defining of adjacent structures, necessary in the case of a permanent specimen requires a much longer time.

The dissection from the dorsal aspect is one which /

which requires much more care and circumspection, for, notwithstanding the reticulate structure of tegmentum of the pons, the fibres which are appreciable in a dissection are almost all disposed, like the fillet, longitudinally. Occasionally one may be fortunate enough to find that these longitudinal fibres in the tegmentum can be lifted away in loose bundles, and the fillet is recognisable at once by its more compact appearance. This occurred in the preliminary dissection which was made from the dorsal surface; and that the suspected structure was actually the fillet was easily proved by exposing it also from the ventral surface. In the specimen of which the photograph is given it was found expedient to make the lateral fillet the starting point, as its deep surface is easily distinguishable and separable from the underlying peduncle. The peduncle was removed and the continuity between the lateral and mesial fillet having been laid bare, the latter was traced inwards and downwards. The chief difficulty which arose afterwards was to avoid a breach in continuity at the point where the fillet is twisted on itself as it passes from the medulla into the pons; and it is possible that in this situation some fillet fibres have been unintentionally removed.

In /

In specimen B. at a little distance to the outer side of the fillet is seen the emerging trunk of the seventh nerve supported by the pin 3. To the inner side of the nerve close to the edge of the fillet is Gowers' tract which will be referred to in a later photograph. It emerges from under cover of the olive (2) and runs up towards the trunk of the fifth nerve (4 pin).

(A description of a method for exposing the fillet could advantageously be introduced into text books, in order that students might acquire a livelier knowledge of this large and important and tangible structure than most of them usually possess, notwithstanding the assiduous study of pictures of transverse sections to which many devote considerable time. A dissection to bring in all details requires a much longer time than could with justice be asked from the student in the strenuous times in which he now lives; but, unless the tedious process of exposing the pyramidal bundles were included as a preliminary step, a dissection from the ventral aspect to expose it sufficiently to carry conviction is relatively simple. It does not interfere with, or exclude, any other presently in vogue, and is attended by fewer /

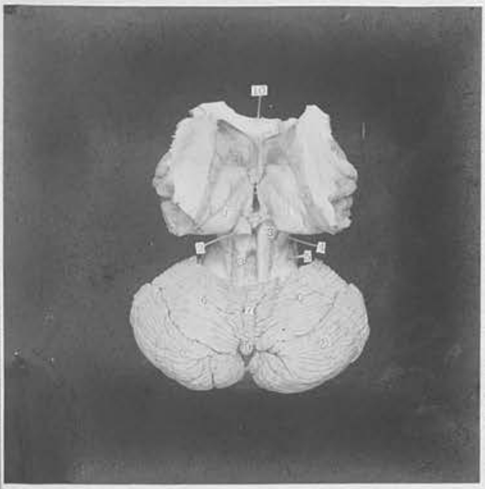
fewer difficulties and disappointments than many which are undertaken by the average dissector in other regions. From an interesting historical note by Dejerine (Vol. 2 part 1 p. 569), it appears that the mesial fillet was known to Haller as long ago as 1756, and the description of the structures, now known as mesial and lateral fillets, given by Reil in 1809 accords with present day observations. The obscurity which has surrounded this structure, i.e. the mesial filet, he ascribes to the confusion arising out of a redundant nomenclature. I know of no other band of fibres (with the exception of the lateral fillet) about which a student's ideas are so nebulous. The haziness of his conception of the fillet cannot now be attributed to multiplicity of names, for the common term in use is THE FILLET; and it is not easy to explain why so many who can give, with confidence and accuracy, an account of the devious course of the seventh cranial nerve from its nucleus to its exit from the skull, should, when asked about the fillet, be beset with hesitation of manner and uncertainty of statement. The term Fillet, itself, at one time sufficiently descriptive, conveys in these days but little meaning, and may contribute to the sense of uncertainty and unreality which prevails. /

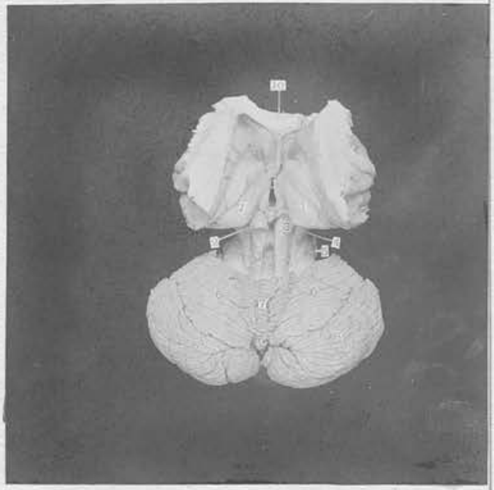
prevails. Although still employed in certain trades, it has passed out of use in current general literature, and to the student is perhaps only reminiscent of certain passages in classical authors pertaining to religious rites of which, as a school boy, he had only a confused understanding (XXIX). To suggest a more descriptive term or a synonymous alternative were needless. The term Fillet is firmly established in this country. Attempts to simplify nomenclature, or to diminish the number of names usually end by adding others to the list: and the fillet has already been overburdened with names. Of this uncertainty and haziness I have had experience both in early undergraduate days and in my tutorial capacity of the last few years. During the last two sessions I have had the gratifying experience of observing the enlightening effect of the display of the fillet upon those whose studies had advanced to the stage at which this structure is an object of curiosity and interest).

P H O T O G R A P H   N O. XXX.

A DISSECTION TO EXPOSE THE DECUSSATION OF THE SUPERIOR CEREBELLAR PEDUNCLES FROM DORSAL ASPECT. AN ACCESSORY PINEAL GLAND IS ALSO SHOWN.

1. Optic thalamus.
2. Superior corpus quadrigeminum.
3. Superior cerebellar peduncle.
4. Lateral border of crusta.
5. Pons.
6. Quadrate lobule of cerebellum.
7. Clivus.
8. Postero - superior lobule.
9. Folium cacuminis and tuber valvulae.
10. Genu of corpus callosum.





The dissection to follow the fillet in natural sequence should be the decussation of the superior cerebellar peduncles from the ventral aspect. That dissection has already been included with those of the cerebrum, and in lieu of it there is one introduced which does not fit in well with any series.

XXX. A DISSECTION TO EXPOSE THE DECUSSATION OF THE SUPERIOR CEREBELLAR PEDUNCLES FROM THE DORSAL ASPECT.

All the parts of the cerebral hemispheres have been taken away except the portion between the island of Reil and the third ventricle. The anterior part of the superior vermis and the corresponding lamellae of the lateral lobes of the cerebellum have been removed, as well as the superior medullary velum, the lateral fillet, both inferior corpora quadrigemina, the right superior corpus quadrigeminum, a great part of the reticular formation of the pons and all that lies between the quadrigeminal bodies and the decussation.

The superior corpus quadrigeminum (2) has been retained on the left side to show the level of the decussation of the peduncles, but the peduncle (3) has been traced towards the under aspect of the optic thalamus (1) on the right side.

The crossing of the two peduncles is seen deeply /

deeply situated between them. Its upper border is above the level of the lower border of the superior quadrigeminal body. The position of the decussation appears at a higher level, viewed from behind in a dissection, than it does on section, owing to the obliquity of the long axis of the mid-brain.

In this specimen an accessory pineal gland is present. It lies upon the dorsal surface of the pineal gland near its base, from which it can be lifted up. It is about two or two and a half millimetres in length and about the same breadth at its base. In general outline it is a normal pineal gland in miniature. Its upper surface is convex. Its under surface is flattened and rests upon the dorsum of the pineal gland to which its base is attached just above the pineal recess. Its basal angles are connected with the dorsal peduncles of the pineal gland. In colour it is paler and in consistence it is firmer than the pineal gland. Both these characters are more marked on its dorsal than on its ventral surface.

I have not seen a similar body in any brain which I have handled, and I have failed as yet to obtain any reference to any paper in which it is described.

Psammoma /

Psammoma suggested itself to me when it was first discovered. I am unfamiliar with the naked eye appearance of psammoma and do not know if the suggestion was justifiable, but the absence of any connection with the brain membranes excluded the possibility. This body may, however, be some manner of tumour growth.

A photograph No. XXXI of another dissection of the decussation of the peduncles is included, as the interval between the peduncles (5) is greater and the decussation can be better seen.

A greater part of the cerebral hemispheres has been retained, but otherwise the dissection has been substantially the same as in the former instance. The upper limit of the decussation is, relative to the superior quadrigeminal body (4) at a somewhat higher level.

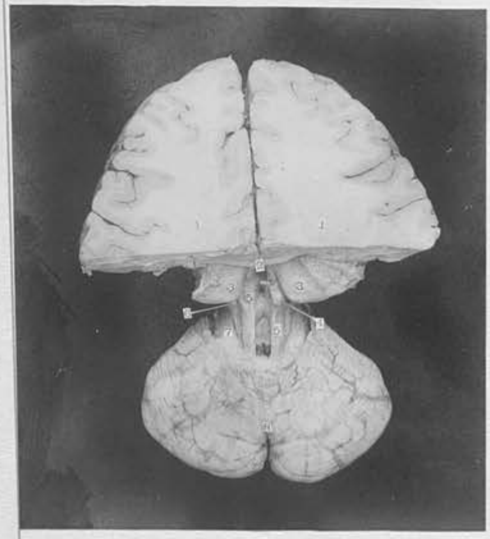
Two features are noticeable in both dissections. The deep position of the decussation and the apparent avoidance of the decussation by a large part of the peduncle.

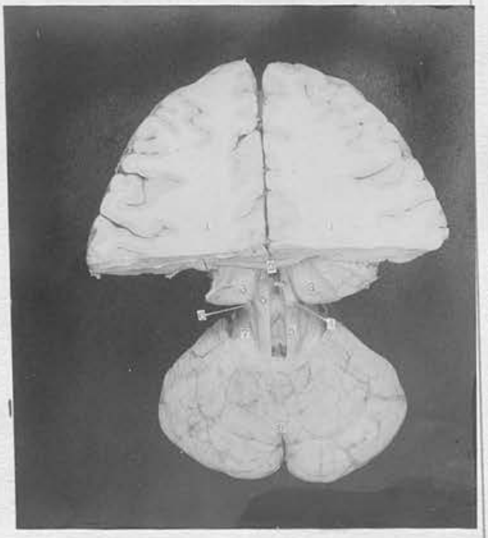
The apparent non-participation in the crossing by such a large proportion of the peduncular fibres has caused me considerable worry; for it is the only instance in which there was a glaring discrepancy between current description based upon histology, /

P H O T O G R A P H   N O. XXXI.

A DISSECTION TO EXPOSE THE DECUSSATION OF THE SUPERIOR CEREBELLAR PEDUNCLES FROM THE DORSAL ASPECT.

1. Centrum ovale minus.
2. Corpus callosum.
3. Optic thalamus.
4. Superior corpus quadrigeminum.
5. Superior Cerebellar peduncle.
6. Lateral border of crusta.
7. Pons.
8. Incisura marsupialis.





histology, and what I found by dissection; and I made several unsuccessful efforts to obtain what I believed to be more in conformity with the actual mutual interrelationship of the peduncles.

The explanation (which no doubt should have been obvious from the first) of this appearance was forthcoming after an examination of the pictures of the sections through this region in Dejerine. In these it is shown that the fibres of the peduncle do not turn directly inwards. Before doing so they run first of all in a ventral direction. By the combination of the ventral and the inward directions a wide curve is formed, open inwards and "dorsal-wards", with the result that a great part of the peduncular substance remains dorsal to the level of the decussation, and a space is enclosed by the peduncule on either side and the decussation in the middle, ventrally - a space filled with gray and reticular substance, and apparent both on section and dissection.

This is a case where dissection divorced from section would lead one into error, for the inner aspect of the peduncle cannot be seen so clearly as the outer and the ventral direction of its fibres is not readily distinguished, and one assumes that before turning inwards their direction is /

is the same as on the outer side where it is undubitably longitudinal.

None the less there seems to be a considerable part of the peduncle which does not decussate. The fibres which form the outer surface of the peduncle do not appear to come nigh the decussation. These fasciculi - which can be traced as clearly as any others in the whole brain by the naked eye - remain on the outer side till they are beyond the place of the decussation. This may be seen no less clearly in the dissection to expose the decussation from the ventral aspect. Moreover, in this connection I may mention the result of an as yet unconfirmed dissection. When the decussation is exposed from both dorsal and ventral aspects in the same specimen the bulk of the decussation, which can then be estimated, is not so great as one peduncle.

Whether the decussation of the superior cerebellar peduncles is complete or not is a subject of debate, and a very brief statement of varying beliefs here follows:

According to Obersteiner (1890) p. 318, the peduncles contain fibres which do not take part in the decussation, (a previous statement is made, p. 241, that the decussation is "complete", but as progressive /

progressive sections are being described the probable meaning is that the decussation is "completed").

According to Marchi 1891 (XXX) a small bundle of the peduncle does not cross but ends in the optic thalamus of the same side.

Ferrier and Turner 1894 (XXXI) say that the intercrossing is complete while Mahaim 1894 (XXXII) found, on the contrary, that the red nucleus of the same side suffered after section of the superior peduncle. Thomas suggests that this may have resulted from injury to neighbouring parts at the time of the section; but a connection between uncrossed fibres of the peduncle and the red nucleus was confirmed by Russell in 1895 (XXXIII).

Thomas 1897 (XXXIV) affirms that the decussation is "total"; and van Gehuchten and Lewandowsky 1905 (XXXV and XXXVI) both bear witness to the same effect.

The preponderance of opinion is towards the view that all the fibres of the peduncle cross, a view which dissection does not support. I incline to go even further than the minority who keep only a small proportion of the peduncular fibres on the same side all through. From repeated dissection I should deny the crossing of a fair proportion /

proportion of the fibres; and that all the fibres of the peduncle cross in Man is a proposition which at the present time I am unable to entertain, the liability of a dissector to error notwithstanding.

The following five dissections have for their ultimate object the exposure of the corpus dentatum from above. The approach to the corpus dentatum entails the gradual demonstration of the disposition of the cerebellar peduncles after they have entered the cerebellum.

The accepted description of the manner of distribution of the fibres of the middle cerebellar peduncle is that the upper fibres radiate in the lower part of the hemisphere, while the lower fibres are distributed to the upper surface and the vermis. (Cunningham's and Morris' text books).
To quote from Thomas (XXXIV. p 98). "D'après les recherches de Bechterew (XXXVII) sur des enfants nouveau-nés âgés de quelques semaines, il y aurait à distinguer deux segments dans le pédoncule cérébelleux moyen: 1° Un segment supérieur, dépourvu de myéline; occupant dans le pédoncule cérébelleux supérieur une situation plus latérale, il se termine dans la partie postérieure et inférieure de l'écorce des hémisphères, et n'envoie aucune fibre dans le vermis; 2° Un segment inferieur myélinisé, situé medialement et dirigé d'arrière en avant, surtout visible dans les coupes de la moitié inférieure du pont; il serait en rapport avec la partie supérieure de l'écorce des hémisphères et avec l'écorce du vermis". ("le pédoncule cérébelleux /

cérébelleux supérieur" should be le ped. cer. moyen).

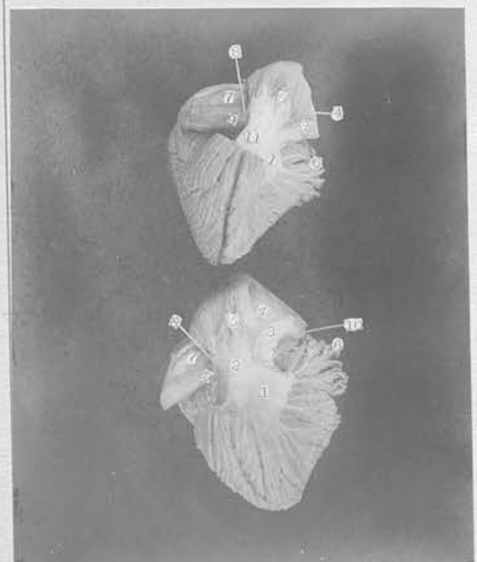
In the chapters of Dejerine's work on the brain which treat of the pons and ~~medulla~~ cerebellum (pp. 482, 507, 517), while the separation of the transverse fibres of the pons into groups by the pyramidal bundles, and the subdivision of the white matter superjacent to the corpus dentatum, are described, there is no mention made of the peculiarities of the arrangement of the fibres of the peduncle as they pass into the cerebellum except in regard to the middle superficial fasciculus whose downward bend towards the eighth nerve is described. Neither Edinger (XX) nor Obersteiner (XIV) nor Testut (XXXVII) appear to enter into detail.

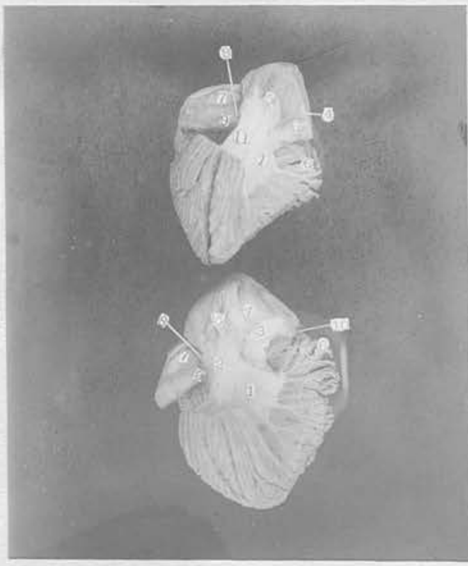
To show the arrangement of the cerebellar peduncle four dissections are necessary. These are presented in two photographs Nos. XXXII and XXXIII. The first stage of the dissection is shown in the lower of the two speciment in photograph No. XXXII. The lobules of the upper surface of the cerebellar hemisphere all except the postero-superior lobule have been removed almost to the middle line. The flocculus, amygdala and the anterior lobules of the under surface have also been taken away. The oblique or middle fasciculus /

PHOTOGRAPH NO. XXXII.

CEREBELLAR PEDUNCLES - FIRST TWO STAGES.

1. Fibres from deep part of pons.
2. Fibres from upper part of pons.
3. Lateral fillet.
4. Crusta.
5. Fifth cranial nerve.
6. Superior cerebellar peduncle.
7. Olive.
8. Eighth cranial nerve.
9. Restiform body.
10. Inferior corpus quadrigeminum.
11. Fibres from lower and superficial part of pons.





fasciculus of the anterior surface of the pons is seen crossing downwards by the inner side of the trigeminal trunk (5) and it has been partly removed as well. Incidentally, the lateral fillet (3) and the superior cerebellar peduncle (6) have been exposed.

After this dissection an examination of the specimen shows that the current description is ostensibly correct. The upper fibres of the pons are gathered together into a bundle (2) which passes downwards and backwards to be distributed mainly to the inferior part of the hemisphere and to the postero-superior lobule. (The outer ends of the lamellae of the upper surface which lie in relation to it also receive fibres from it as it passes backwards). The lower fibres of the pons, on the other hand, sink underneath this bundle and appear to emerge again (1) from under its cover at its inner edge and to radiate inwards towards the vermis, giving off lamellae to the superior lobules. (Lying upon the superior peduncle as it comes out of the cerebellum a thin layer of fibres may be seen which appear to belong to this group, but the succeeding dissections proved it to be the anterior edge of the inferior peduncle).

By subsequent dissections of the cerebellum in /

in this series the arrangement of the middle peduncular fibres was shown to be not so simple. In each of these the steps of the preceding dissection or dissections, were repeated in detail in order to obtain confirmatory evidence.

The upper specimen in the photograph No. XXXII. represents the second stage. The same parts have been removed as in the former, and, in addition, a greater portion of the oblique fasciculus and the whole of the bundle derived from the upper part of the pons have been taken away.

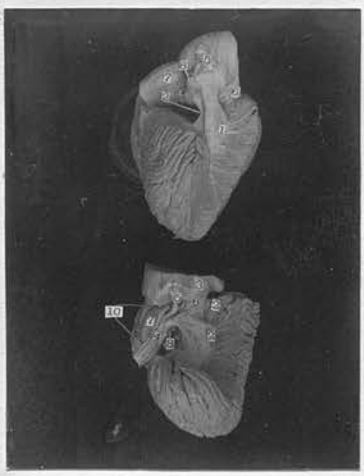
It can now be observed that the lower superficial fibres of the pons do not comport themselves in the way that seemed obvious in the first stage. It is true that they disappear under cover of the upper bundle, but they do not cross it to reappear. They continue backwards under cover of the superior bundle, and are also distributed to the lobules on the inferior surface of the cerebellum, but nearer the middle line. The fibres (1) which appeared in the former specimen to be continuations of the lower superficial fibres of the pons are seen to come from the deeper parts of the ventral division of the pons: and they are better shown in the next photograph.

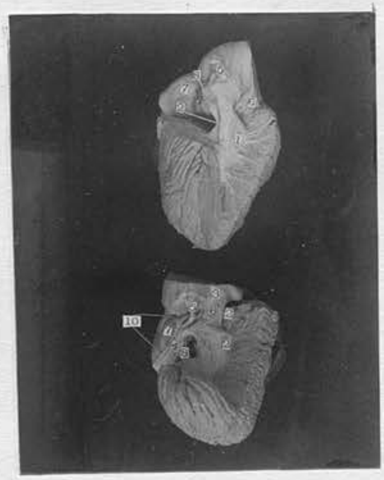
In /

P H O T O G R A P H No. XXXIII.

CEREBELLAR PEDUNCLES - THIRD AND FOURTH STAGES.

1. Fibres from deepest part of Pons.
2. Inferior Cerebellar Peduncle.
3. Lateral Fillet.
4. Spinal root of Fifth Nerve.
5. Trunk of Fifth Nerve.
6. Superior Cerebellar Peduncle.
7. Olive.
8. Eighth Nerve.
9. Restiform Body.
10. Gowers' Tract.





In photograph No. XXXIII. the upper of the two specimens shows the third stage in the exposure of the peduncles. The steps of the dissection were the same as in the second stage, and the lowest bundle of the peduncular fibres has been removed as well. By so doing the relationship to the pons of the fibres (1) of the middle peduncle which sweep inwards towards the vermis is shown, and the lower edge of the sheet formed by the inferior peduncle (2) has been exposed. This step makes it more obvious that these fibres which appear (in the first number of the series) from under cover of the bundle composed of upper pontine fibres, are not connected with the superficial fibres of the lower part of the pons, but are the continuations of the deep fibres of the lower and middle part of the pons.

At first they form a compact bundle which lies under cover of both the bundles already dealt with, and, appearing at the inner side of the more superficial of these bundles, they spread out, and extend inwards towards the vermis covering the inferior peduncular sheet all except its upper and lower edges. As the fibres proceed inwards they form curves whose convexities are directed backwards and whose radii vary in length; and the whole bundle so spread out corresponds to the external semicircular fibres of Dejerine. (The connection

which /

which Dejerine describes between the superficial fibres of the pons and the external semicircular fibres will be referred to later).

Dejerine divides the transverse fibres of the ventral division of the pons into three sets: one in front of the pyramidal bundles, one behind, and a middle, which is broken up by the pyramidal bundles.

The anterior group extends from the upper to the lower border of pons The posterior lies mainly in the lower two-thirds, the middle lies in the upper two-thirds. But these three great groups of the fibres internal to the trunk of the fifth nerve do not correspond to the three bundles found external to the nerve. The deepest bundle corresponds pretty closely in position to the posterior division, as it seems to be formed from the deepest or most posterior fibres of the lower two-thirds of the pons. But the lower superficial bundle appears also to contain some middle and some deep fibres of the lower half of the pons; and the uppermost bundle is composed of both superficial and middle, and possibly some of the uppermost of the deep fibres.

It is possible that a few of the upper layers of the external semicircular fibres may be formed by the superficial fibres of the pons as Dejerine avers, and for evidence of which he refers to figs. 361, /

361, 362, and 427, to 435; but, if so, they are taken away with the removed lobules. There was little evidence of such a connection in the dissection, and in dealing with large bundles of fibres it is questionable if less reliance is to be placed upon a dissection than on sections where the fibres are cut, some obliquely, some transversely and some longitudinally.

It appears therefore from the series of dissections that the transverse fibres of the pons, as they pass from pons to peduncle, arrange themselves not into two bundles but into three. (a) The uppermost, which is likewise the most superficial, is composed of superficial, middle, and probably deep fibres of the upper part of the pons. It passes backwards and somewhat outwards and downwards, over the other two bundles and is distributed to the lobules on the under surface of the cerebellar hemisphere and to the portions of the upper surface adjoining the posterior and lateral margins. A variable bundle, the oblique fasciculus, is more or less detached from it and bends downwards by the inner side of the fifth nerve towards the eighth nerve and is destined for the more anterior parts of the under surface of the cerebellum.

(b) The lowest bundle is formed from the most inferior of the superficial, middle and deep fibres of /

of the pons. It disappears under cover of the upper bundle, and extends backwards and downwards more or less parallel with the upper bundle, and is distributed to inferior lobules of the cerebellum in closer proximity to the vermis. It lies in front of and below the third bundle and hides the posterior or lower edge of the inferior cerebellar peduncle.

(c) The middle or deep bundle is made up of the majority of the deepest or most posterior of the transverse fibres of the pons. It is placed first under cover of the upper bundle, but, crossing it, appears at its inner side and its fibres spreading out, extend in a curvilinear manner inwards and backwards towards the vermis cerebelli. They cover the greater part of the inferior cerebellar peduncle which lies between them and the corpus dentatum, and they are sent off into the white cores of the upper anterior cerebellar folia.

The lower specimen in photograph NO. XXXIII. is the fourth representative of this series. The whole of the middle peduncle has been removed to expose the inferior peduncle. In the process of doing so all the various steps of its three predecessors were repeated.

The Inferior cerebellar peduncle (2) is seen in all the essential parts of its course: ascending /

ascending from the medulla to the dorsum of the pons; leaving the pons straightway and bending at an angle to enter the cerebellum; proceeding fanwise inwards towards the vermis. From a dissection of this kind the mind can receive in a moment all the information to supply which many consecutive sections are required. Although the peduncle bends at a sharp angle - which is always a source of apprehension in a dissection - yet it is so compact and the fibreing so distinct that there is little difficulty in following it from below upwards. After the removal of the middle peduncle there is little to be done beyond scraping the vestibular root of the eighth nerve. The cochlear root (8) has been left as its presence does not interfere with a continuous view of the peduncle, and it is a landmark.

While the exposure of the inferior peduncle is the salient feature in this dissection, other structures have also been brought into view in order to show their relations. The spinal root (4) of the fifth nerve has been denuded of its superficial relations. It has been traced as far downwards as the specimen permitted, and its junction with the trunk of the nerve (5) has been demonstrated. The superficial aspect of the root is much broken up by the roots of the ninth and tenth /

tenth nerves, but if moderate care be exercised in the extraction of these, there need be no rupture, and the integrity of the fibres of the spinal root can be maintained. The manner in which it broadens out over the tubercle of Rolando is clearly seen. To preserve the trunk of the fifth nerve from injury during the removal of the middle peduncle is a matter of greater difficulty. It has not the advantage of the superficial position enjoyed by the spinal root, and hence the hardening preservative fluid, even with intravascular injection, has not the same opportunity of acting upon it. Moreover the trunk of the nerve is not a rounded bundle in the pons, but is much compressed and flattened from above downwards (i.e. cephalo-caudalwards) and is at the same time more broken up by fibres passing from pons to peduncle than the recollection of sections of the pons through the nerve led me to infer. However, the inferior or caudal aspect of the nerve, which is continuous with the spinal root, is a beautiful glossy surface, and can readily be exposed either by following up the spinal root, or by tracing the nerve "dorsalwards" from its point of emergence.

Appearing from underneath the superior cerebellar peduncle (6) is a small fasciculus which runs downwards to join the trunk of the nerve. That is the /

the mesencephalic root. It is not only small but very soft, and, while in some cases it obtrudes itself in the dissection, it may very readily be missed.

The figure 10 is placed on a bent wire one pillar of which is inserted into Gowers' tract immediately below the alive (7). The upper pillar is set into a very discrete bundle of fibres which emerges from under cover of the olive, and, as is shown in another photograph - No. XXIX - it passes upwards between the emerging trunk of the seventh nerve and the edge of the fillet to disappear dorsal to the mesial fillet near its union with the lateral fillet. In dissections from the dorsal aspect I have been able to trace it as a distinct bundle for only a little distance beyond this point. (Throughout the whole series of dissections I have been on guard against making artificial bundles, although I have not found that this danger is so ever-present as may at first appear inevitable from the nature of the work. It is not often that an individualised tract of fibres has not been recognised, although its identity may have been doubtful at first, owing to its dis-closure from a new point of view. A considerable number of the dissections have automatically suggested /

suggested themselves, for in the process of dissecting one structure, others were encountered, sometimes with unexpected clearness, and these formed the bases of subsequent dissections; and this fact has kept my own mind free from the suspicion that the tract sought for was being brought into relief by artifact: it had been previously met with when the mind was devoid of intention. (For identification of some doubtful structures which appeared incidentally in certain dissection I have been indebted to Dr. Alexander Bruce, Professor Cunningham, and the letter press in Dejerine).

This small bundle has been made out in all the dissections dealing with the region of the pons above the olive. It emerges from under cover of the olive, and it is clear that the fibres of Gowers' tract which run upwards behind the olive are continued into it. For these reasons I have labelled it Gowers' tract. While I was yet doubtful as to its identity I was kindly permitted to examine some microscopical specimens in which Gowers' tract was to be seen, belonging to the physiology department. As a result of this examination I still label it Gowers' tract, with the reservation that while Gowers' tract is certainly in the bundle, there is more in the bundle than fibres of Gowers' tract. /

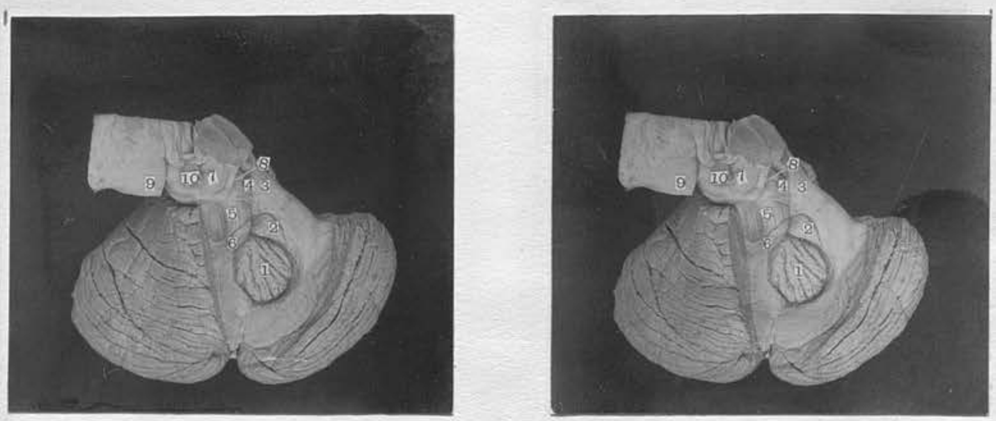
The emerging trunk of the seventh cranial nerve has been plucked out of the narrow space that is seen between Gowers' tract and the spinal root of the fifth nerve; so that if the imagination replace the eliminated facial and vestibular nerves one can see in a line passing inwards and upwards from the figure 8: the cochlear nerve (8), the inferior peduncle (2), the vestibular nerve, the upper part of the spinal root (4) of the fifth nerve, the facial nerve, Gowers' tract (10).

What remains of the lateral fillet has been exposed. (Whenever possible I have exposed the lateral fillet. For these specimens will have an abiding place where they can be seen by students; and notwithstanding that the elevation produced by the lateral fillet is distinguishable in an undissected brain, and that it is described with precision and figured in text books, I am afraid that owing to its inclusion in the intricate path of sound it is regarded by many rather as an hypothesis than an entity. By obtrusive repetition I have sought to impress them otherwise).

P H O T O G R A P H   No. XXXIV.

A DISSECTION TO SHOW FROM ABOVE THE CORPUS DENTATUM OF THE CEREBELLUM, THE SUPERIOR, MIDDLE, AND PART OF THE INFERIOR CEREBELLAR PEDUNCLES, AND THE LATERAL FILLET.

1. Corpus Dentatum.
2. Stumps of Inferior Peduncle, and deepest fibres of the Middle Peduncle.
3. Junction of Pons and Middle Peduncle.
4. Lateral Fillet.
5. Superior Cerebellar Peduncle.
6. The retained anterior edge of Inferior Peduncle.
7. Superior Corpus Quadrigeminum.
8. Inferior Brachium.
9. Pulvinar.



The final stage in the exposure of the corpus dentatum from above is part of a dissection which like the last includes more than one feature.

XXXIV. A DISSECTION TO SHOW FROM ABOVE THE CORPUS DENTATUM OF THE CEREBELLUM, THE SUPERIOR, MIDDLE AND PART OF THE INFERIOR CEREBELLAR PEDUNCLE, AND THE LATERAL FILLET.

A clean cut has been made through the superior vermis, near the middle line, down to the white stem of the arbor vitae, and the laminae of the right half of the superior vermis and of the great part of the upper surface of the cerebellar hemisphere have been removed, together with the underlying white matter down to the level of the corpus dentatum (1). Up to this point the dissection is the work of a few minutes. There follows the tedious process of defining the margins of the corpus dentatum, and picking the white matter out of the furrows on its upper surface, a labour which is attended by the continual danger of carrying off large pieces of the soft gray matter of the nucleus with the firmer white matter. The danger is greatly lessened when the colour contrast between the gray and the white is well marked.

The corpus dentatum shown here is somewhat broader /

broader and has an outline more nearly circular than any other which I have exposed. This is no doubt due to the cerebellum being slightly flattened from above downwards. Dissections of this nucleus usually show that the ridges or folds, since the anterior end is the narrower, converge and join as they are traced forwards, leaving one or two which extend from one end to the other. In this instance it may be noted that one of the ridges divides, and effects only a partial junction with its neighbour. Seven or eight ridges are seen from this point of view, and there is very little variation in number.

The triangular stump (2), which is seen to the outer side and in front of the nucleus, is composed externally of those fibres of the middle peduncle which come from the deeper part of the pons and cross under cover of the other fibres of the middle peduncle to reach the upper part of the hemisphere. The inner angle of the stump is formed by the inferior peduncle.

In order to show the position of the anterior edge of the out-spread inferior peduncle, the fibres which compose that edge have been left. They form the band which is seen stretching inwards across the superior peduncle just in front of the corpus dentatum, and are numbered 6.

The /

The superficial coating of the superior cerebellar peduncle (5) and of the lateral fillet has been scraped off in order to show distinctly the direction of their fibres, and the relations of the two to one another and to neighbouring structures.

The relations of the cerebellar peduncles to one another are well seen in this photograph as well as the relations of the superior and inferior peduncles to the corpus dentatum.

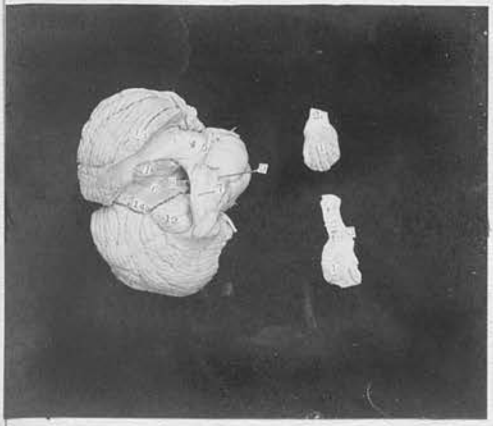
The pin of the figure 8 is inserted just under cover of the inferior brachium. The lateralfillet is well seen in all its superficial extent, from its emergence out of the sulcus below to its disappearance under cover of the inferior brachium, the inferior corpus quadrigeminum and the corpus geniculatum.internum (which is cut). The exposure of the lateral fillet is the simplest of all these dissections of the brain. In a well preserved specimen it forms a distinctly elevated field whose posterior free boundary is well marked, and to remove its homogeneous-looking coating with a sharp pointed pair of forceps consumes a very short time.

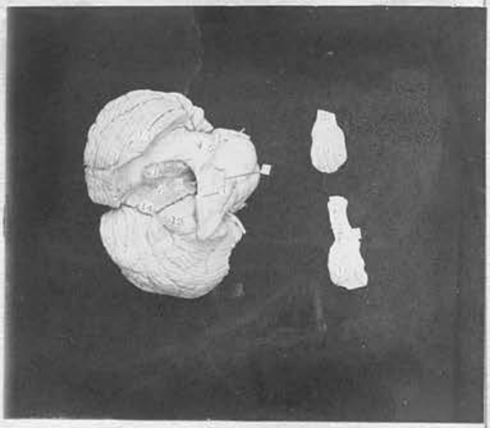
PHOTOGRAPH NO. XXXV.

TWO DISSECTIONS OF ENUCLEATED CORPORA DENTATA.

A DISSECTION TO SHOW THE UNDER SURFACE OF THE CORPUS DENTATUM IN SITU, AND THE COCHLEAR AND VESTIBULAR DIVISIONS OF THE EIGHTH CRANIAL NERVE.

1. Corpus dentatum.
2. Superior cerebellar peduncle.
3. Cut end of fibres which form the dorsal edge of the peduncle.
4. Middle cerebellar peduncle.
5. Eighth nerve.
6. Inferior cerebellar peduncle.
7. Spinal root of fifth nerve.
8. Descending branch of vestibular. nerve.
9. Olive.
12. Amygdala.
13. Lobulus gracilis.
14. Pyramid of vermis.





Supplementary dissections of the corpus dentatum are shown in the following:

XXXV. A DISSECTION TO SHOW THE UNDER SURFACE OF THE CORPUS DENTATUM IN SITU, AND THE COCHLEAR AND VECTIBULAR DIVISIONS OF THE EIGHTH NERVE. TWO DISSECTIONS OF ENUCLEATED CORPORA DENTATA.

Each of the two small specimens is a corpus dentatum (1) freed from all contiguous white matter except the superior cerebellar peduncle (2). They are both from the right side. The upper specimen shows the dorsal surface; the lower shows the ventral surface. It may be noted that the gray matter encroaches on the ventral aspect to a relatively small extent, and scarcely at all along the inner side, and therefore the corpus dentatum is much more readily defined from the ventral aspect than from the dorsal.

The figure 3 is laid upon the cut end of the bundle of fibres which forms the dorsal edge of the peduncle, and which comes not from the corpus dentatum but out of the while central substance of the vermis. In the upper specimen this cut end appears as a projection on the inner side, i.e. the left hand side of the specimen just in front of the nucleus.

In the larger specimen the inferior vermis was bisected; and the righthalf of the vermis, the inferior /

inferior medullary velum and flocculus, the digastric lobule and inner part of the lobulus gracilis have been removed. The thin white coating of the under surface of the corpus dentatum (1) has been taken away and a general conception of the position and form of the nucleus can be obtained.

The principal item in this dissection is the display of the relationship of the divisions of the eighth nerve to the inferior peduncle or restiform body, and the descending portion of the vestibular division. The eighth nerve is numbered 5, and to its inner side is seen the more slender seventh nerve. The pin of the figure 6 is inserted into the inferior peduncle above the level at which it is clasped by the roots of the eighth nerve. The cut end of the peduncle with the embracing roots of the nerve is not so convincingly shown in this photograph as in the following; but the descending branch of the vestibular nerve, which is indicated by the pin bearing the figure 8, is very clearly seen, passing downwards from the inner side of the cut end of the peduncle towards the cuneate and gracile nuclei, to within a short distance of which it can be traced.

The dissection was suggested to me by one of the /

the members of thepractical anatomy class, and of all the disections on the brain it is, perhaps, the most exasperating. The relation of the cochlear division to the restiform body is patent to all eyes without dissection, and the display of the vestibular division requires little else than the removal of the restiform body below the level of the eighth nerve. Prior to attempting this dissection I had exposed the greater part of the intrapontine course of the seventh nerve, and anticipated that the exposure of the eighth nerve would be attended by fewer disabilities; and, no doubt, that would be the case if an endeavour were not made to show the descending part. But any tract of fibres which bends at any degree less than an obtuse angle is difficult to follow, and the smaller the tract, the greater the difficulty, for if the forceps slip but half a milli-metre the dissection may be spoilt. The auditory nerve is, moreover, very appropriately named the Portio mollis; and, in tracing the vestibular division, only the slightest pressure of the forceps, compatible with any progress at all, was possible, lest the nerve should be ruptured. The vestibular division is rendered less accessible, if the cochlear division is retained as here, owing to its higher level; /

level; and the great body of cerebello-olwary fibres in the restiform body run in very nearly the same direction as the descending branch, so that to show the descending branch it must be approached by following the whole course of the vestibular division backwards from the surface. Even doing so, it probably would be well nigh impossible to expose it with certainty, were it not that the fibres of the descending division of the nerve are, in bulk, paler than those of the deeper parts of the restiform body.

The result of these drawbacks is that the dissection, instead of being completed in a few movements, may be protracted over many vexatious hours, for which the meagre compensation is the opportunity given of confirming microscopical observations by the naked eye, as to the principal constituents of the restiform body. For, granted a suitable specimen, one can not only see the ventral superficial arcuate fibres and the direct cerebellar tract approaching and joining the restiform body, before the dissection is commenced, but can also, during the course of the dissection, estimate how much of it is composed of dorsal superficial arcuate fibres, and make out that a great part of it is composed of fibres which reach it by traversing the spinal root of the fifth nerve.

The /

The superficial arcuate fibres were removed from the surface of the spinal root of the fifth nerve which was still further defined, and may be seen extending upwards and sinking into the pons between the seventh and vestibular nerves.

Another photograph - No. XXXVI. of the same dissections is included as certain points are better shown. The under surface of the corpus dentatum _in situ_ is better seen.

The isolated corpus dentatum belongs to the left side and possesses more of the typical shape and characters than any hitherto shown. By a cursory glance at either aspect, not critical enough to note excess of digitation, a resemblance may be observed to a hand whole fingers are flexed at both interphalangeal joints and whose thumb is adduced and slightly flexed. In the larger specimen the extent to which the hilum containing the superior peduncle invades the inferior surface (forming the palm of the hand) is seen, as well as its position nearer the inner side than the outer side of the nucleus.

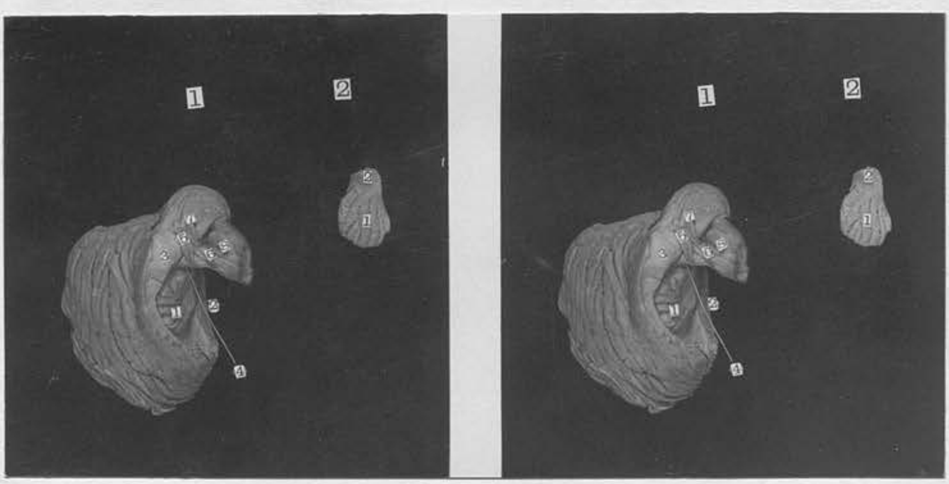
The manner in which the eighth nerve (5) embraces the inferior peduncle (4) is shown with great clearness, but at the expense of the descending /

P H O T O G R A P H   N O. XXXVI.

1. A DISSECTION SHOWING THE VENTRAL SURFACE OF THE CORPUS DENTATUM IN SITU, AND THE COCHLEAR AND VESTIBULAR DIVISIONS OF THE AUDITORY NERVE.

2. ENUCLEATED CORPUS DENTATUM.

1. Corpus dentatum.
2. Superior cerebellar peduncle.
3. Middle cerebellar peduncle.
4. Inferior cerebellar peduncle.
5. Eighth nerve.
6. Spinal root of fifth nerve.
7. Seventh nerve.
8. Olive.



descending branch of the vestibular division, only a small part of which is visible immediately behind the figure 6.

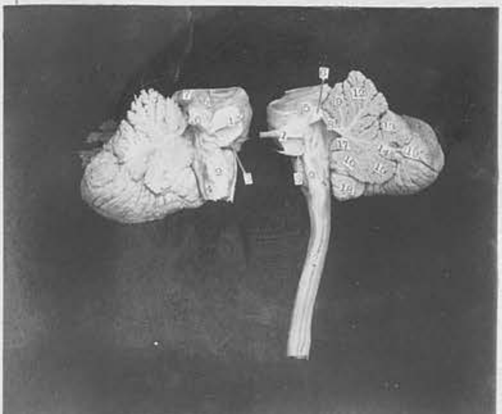
Clarke and Horsley (XXXVIII) have lately made the very definite pronouncement that "No fibres issuing from the cortex cerebelli enter any of the peduncles. All fibres leaving the cerebellum by way of peduncles have origin in one or other of the cerebellar nuclei." Dissection is not of much assistance in confirming or rebutting their conclusion; but the band of fibres numbered 3 in photograph XXXV. came out of the vermis. These fibres form the dorsal part of the superior peduncle These I took to be the "faisceau en crochet" of Thomas (XXXIV) which were previously described by Russell (XXXIII) as crossing in the vermis from the opposite side of the middle line. This decussation has been apparently confirmed by Lewandowsky (XXXVI). In the same cerebellum I traced these fibres on both sides in their short course from the peduncle inwards to the vermis, and sought to obtain a decussation, but was unable to do so. While admitting that such a decussation could be very readily missed, the dissection is, so far, in support of the opinion of Probst (XXXIX) cited in a review by Gordon Holmes in <u>Brain</u> 1905, namely, /

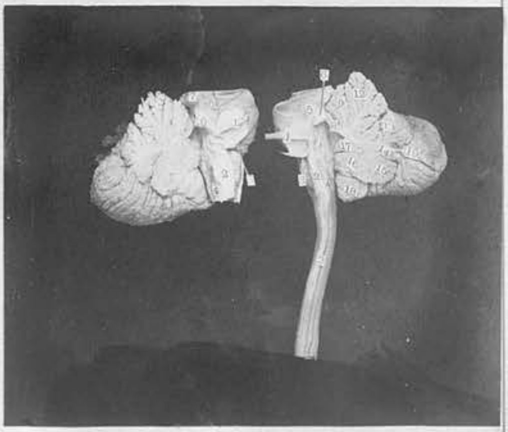
namely, that this bundle has its origin in the nucleus tecti.

PHOTOGRAPH NO. XXXVII.

TWO DISSECTIONS SHOWING THE FIFTH AND SEVENTH CRANIAL NERVES.

1. Trunk of fifth nerve.
2. Spinal root of fifth nerve.
3. Seventh nerve.
4. Level of the clava.
5. Lateral fillet.
6. Superior cerebellar peduncle.
7. Inferior corpus quadrigeminum.
8. Lingula.
9. Central lobule
12. Culmen.
13. Clivus.
14. Tuber valvulae.
15. Pyramid.
16. Uvula.
17. Nodule.
18. Amygdala.
19. Postero-superior lobule.





The concluding dissections deal with the seventh cranial nerve.

In the right hand specimen shown in photograph No. XXXVII. the fifth nerve and its long roots have been retained; in the left hand specimen a section of the spinal root in the vicinity of the seventh nerve has been cut out. In both specimens one half of the cerebellum has been removed, and the roots of the eighth nerve and most of the restiform body have been taken away.

In the left hand specimen the trunk and spinal root of the fifth nerve were first exposed. The seventh nerve was then followed from the lower border of the pons to its disappearance under the spinal root, and the overlying part of the latter was cut away. The seventh nerve was than traced backwards along its course to near the middle line by removing the ependyma and gray matter in the floor of the fourth ventricle; and to bring it into relief the adjacent substance was removed for some distance on either side. The nerve is soft and liable to be pulled away, but, as the subjacent fibres run longitudinally, it is easily enough distinguished and can be traced to very near the middle where it becomes continuous with the ascending portion of the nerve. The ascending portion /

portion does not stand out clearly from the subjacent longitudinal fibres, but its continuity with the horizontal portion can be made out. The horizontal portion of the nerve is flattened dorso-ventrally, and runs obliquely from without, inwards and upwards, therefore in following the upper edge of this flattened band, as it meets the longitudinal fibres near the middle line at an obtuse angle, it appears at first sight to be continuous with the longitudinal fibres above rather than with the ascending portion of the nerve below.

Although the ascending and horizontal portions of the nerve meet at an acute angle, the continuity of their fibres can be made out.

The presence of the nucleus of the sixth nerve assists in this, and it gives an indication also of how much of the longitudinally directed fibres belongs to the ascending part of the nerve; for the nucleus is found in the angle between the two portions, and insinuates itself under their junction, so that the upper end of the ascending portion and the inner end of the horizontal portion are, as it were, lifted up from subjacent fibres. The presence of the nucleus of the sixth nerve was surprisingly evident in this dissection, for it was distinguished from all its surroundings by its reddish-gray colour. The /

The ascending portion of the nerve can be traced downwards till it effects its junction with the radicular portion. Beyond that it is not possible to go without artifact. I have made more than one attempt, each time, so far, unsuccessfully, to demonstrate the radicular portion of the nerve. The fibres in this part of the course of the nerve are so scattered (Vide Cunningham's Anatomy, illustration of section through lower part of pons, p 463, and Dejerine Vol. 2 part 1, corresponding section, p 638), that the substance which separates them from one another would require to be kept so as to give them sufficient stability for permanence; but in no case yet have I found a large enough number of dorsally directed fibres, sufficiently close together, to make a semblance of the nerve root. Nevertheless it is possible to detect, with the naked eye, minute isolated bundles of the root; and I am in hopes of being able, should I at any time obtain possession of a brain in which the fibreing is unusually distinct, to show the whole intrapontine course of the seventh nerve.

The attempt to approach the radicular portion from the ascending is only successful in showing the dorsal end of the radicular portion where it is more compact. The attempt to discover it from the /

the outer side has failed signally, for one has to approach it haphazard. Sections are of great help occasionally in identifying a structure once that it is exposed, and sections give a general idea of the position of a tract of fibres, but for the precise location of a small, hidden tract like the seventh nerve sections are of astonishingly little assistance as a means of guidance in dissection; and pictures which have in them the smallest element of diagram or schema are totally misleading.

In the dissection to the right the trunk (1) and the spinal root (2) of the fifth nerve have been exposed. The spinal root was defined as far down as its increasing tenuity would allow, that is, to a short distance below the lower figure 2. The mesencephalic root is unnumbered, but may be seen joining the trunk from above.

The seventh nerve (3) was traced, as in the other case, from the surface to the spinal root of the fifth nerve. The spinal root has been left _in situ_. This dissection is, therefore, the more difficult of the two; for the seventh nerve can be followed no longer from its peripheral end. It has to be picked up anew on the further side of the spinal root of the fifth, and before it is discovered /

discovered again it may be accidentally torn away. One expects to be able to estimate its position by observing the direction of the fibres of the portion already uncovered. This calculation is misleading. Reference to both specimens in the photograph will show that the seventh nerve, just before it emerges from under cover of the spinal root of the fifth, makes a bend "caudalwards" to gain the lower border of the pons, and although I had been made aware of the presence of this bend by other dissections in which the spinal root had been removed, the acuteness and the effect of the bend were not easy to compute.

Another photograph of similar dissections is added in order to show the position and direction of the third or horizontal part of the nerve more clearly.

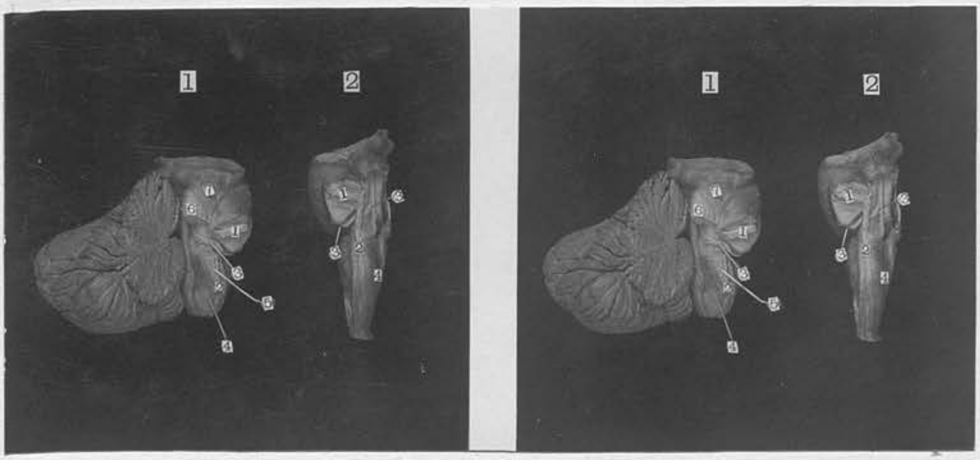
The horizontal portion of the seventh nerve does not, in its course across the floor of the fourth ventricle, run directly outwards. There is an inclination backwards, i.e. caudalwards, at the same time. This obliquity, as stated above, makes it appear to be continuous, with longitudinal fibres above rather than below when the nerve is traced inwards towards the middle line.

In /

P H O T O G R A P H   N O.   XXXVIII.

TWO DISSECTIONS SHOWING THE FIFTH AND SEVENTH NERVES.

1. Trunk of fifth nerve.
2. Spinal root of fifth nerve.
3. Seventh nerve.
4. Level of the clava.
5. Cerebello - olivary fibres.
6. Superior cerebellar peduncle.
7. Lateral fillet.



In the section of the pons at this level (fig. 428, p. 635) Dejerine has been fortunate in obtaining a view of the whole length of the horizontal part on the right hand side. This may be accounted for by assuming that the section was slightly oblique. In the specimen shown in photograph No. XXXVII. an absolutely transverse section might, by passing diagonally through the nerve, include the whole extent, but the breadth and direction of this portion of the nerve in the specimen shown in photograph No. XXXVIII. does not seem to be such as to permit this contingency. The presence or absence of the whole extent of the horizontal portion in the left hand side of Dejerine's section would settle the question of obliquity, were it not that that side is employed for the schematic presentation of the objects set out in detail on the other side.

Having crossed the floor of the ventricle, the nerve is seen to bend again, as Dejerine describes, in a ventral direction and somewhat outwards. It also maintains the same degree of backward or caudalward inclination exhibited by the horizontal portion. This inclination cannot suffice to bring it to the lower border of the pons, and, therefore, just before the nerve escapes from under cover of the /

the spinal root of the fifth, it is suddenly accentuated, and the nerve runs caudalwards almost parallel to the spinal root before finally appearing on the surface. In the right hand specimen of photograph No. XXXVII. the pin of the figure 3 indicates the point at which the seventh nerve appears free on the surface. The bend is scarcely indicated in Dejerine's sections, and it is shown in a minor degree in the reconstruction models of Florence R. Sabin (XII).

With the dissections of the seventh nerve the series of preparations of the brain-stem and cerebellum are completed.

With the exception of the tracing downwards of spinal root of the fifth nerve, there has been made only one dissection which implicated the spinal cord.

But that dissection has not been included amongst the others, because, firstly, the specimen is not now in my possession and I have not yet been able to secure a suitable spinal cord on which to reproduce it, and secondly because the idea was copied out of an old atlas. The dissection consisted in removing the decussating bundles of the pyramids on one side, so as to show the bundles crossing from the other side. These were then traced /

traced down the lateral column of the cord, while the direct tract from the same pyramid was followed almost to its termination.

All the other dissections have been projected by myself, or have been self-suggested, or have been suggested verbally by other people, as for example the dissection of the eighth nerve, the possibility of showing which was brought before my notice by a student, and the dissection of Rhinencephalon which was the outcome of a direct suggestion made by Professor Cunningham. Two others - the dissection of the floor and roof of the ventricular horns and that which shows the corona radiata and its relation to the basal ganglia - were suggested to me by my brother, Dr. J. K. Jamieson of the University of Leeds.

The hippocampus major was the last structure to engage my attention and has been only very lately completed, and with it all the projected series were completed; and there does not seem to be much possibility of further expansion of the series in regard to the normal human brain. But as opportunities present themselves, I hope to be able to add to their number and value by extending their scope so as to include specimens illustrative of congenital cerebral deficiencies and of comparative anatomy.

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