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AN ANATOMIC STUDY OF THE FASCICULUS OCCIPITO-FRONTALIS AND THE TAPETUM¹

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The exact anatomic relations of the fasciculus occipito-frontalis has been the subject of much controversy since Onufrowicz (1) first described in 1887 in the brain of a microcephalic idiot in which the corpus callosum was lacking, the presence of a large fronto-occipital association bundle. A similar finding was afterwards described by Hochhaus (2), Kaufmann (3) and Forel (4).

Dejerine (5) identified this bundle with one which he described in the normal brain as extending along the external angle of the lateral ventricle, within the corona radiata, above the caudate nucleus and beneath and external to the corpus callosum, and between the cingulum and the superior longitudinal bundle of Burdach. It is separated from the ventricular cavity by the subependymal gray matter.

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It measures one half centimeter in thickness in vertico-transverse sections and is pyriform in shape. Clearly defined at the level of the head and trunk of the caudate nucleus it becomes less so at the tail of the latter. Posteriorly these fibers spread out upon the inferior and external wall of the sphenoidal horn forming the tapetum.

This bundle originates in the cortex of the frontal lobe, receiving fibers from the superior and external portion of the hemisphere and enters into the external capsule, crossing probably the fibers of the *forceps major*.

The *fasciculus occipito-frontalis* degenerates after lesions of the occipital lobe, according to Dejerine, and he believed that it corresponds to the "*couronne rayonnante du noyau caudé*" of Meynert and to the "*faisceau du corps calleux se rendant à la capsule interne*" of Wernicke.

These fibers, he states, are not identical with the "*faisceau longitudinal supérieur*" (arqué de Burdach) as maintained by Forel and Onufrowicz as well as Kaufmann and Hochhaus, for Dejerine claims that, while the *faisceau longitudinalis superioris* is situated external to the corona radiata, the "*faisceau occipito-frontal*" is situated on the contrary internal to the corona radiata and forms a sort of a vault to the lateral ventricle.

According to Meynert (in Dejerine) the "*couronne rayonnante du noyau caudé*" is composed of fibers which, originating in the caudate nucleus, proceed then to the convolutions of the superior part of the hemisphere. But Dejerine, with Wernicke, did not believe that any of these fibers terminate in the caudate nucleus. Wernicke (in Dejerine) believed however, that these fibers constitute the "*faisceau du corps calleux se rendant à la capsule interne*" (*Balkenbündel zur inneren Kapsel*) arising from the knee of the corpus callosum and the white matter of the frontal lobe. These fibers form a compact bundle, measuring one and one half centimeters in thickness, and extend along the superior external border of the caudate nucleus, the fibers penetrating into the internal capsule between the caudate nucleus and the superior border of the putamen at the level of the middle part of the optic thalamus. But Dejerine did not accept this as proved and was of the opinion that this bundle can be identified with the *fasciculus occipito-frontalis* described by Forel and Onufrowicz in cases of agenesis of the corpus callosum.

Sachs (6) who examined the specimens of Kaufmann was convinced that the latter's case was not one in which the corpus

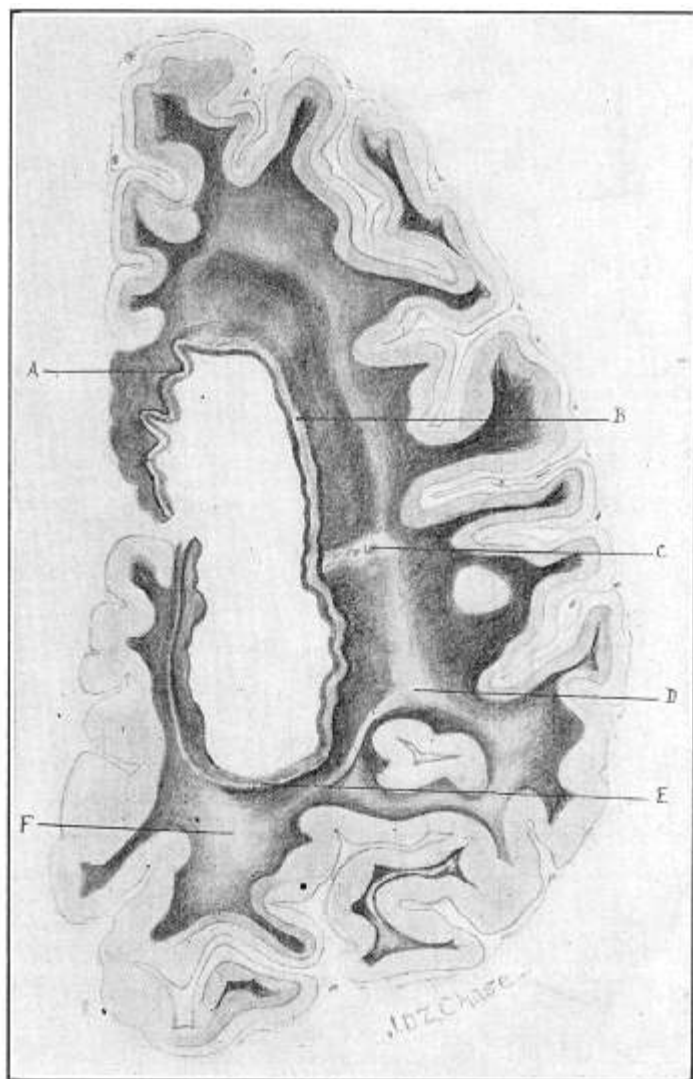


FIG. 1. (Right side.) *A*, area of degeneration which appears to be continuous with the degenerated fasciculus occipito-frontalis at *B* which can be traced around the ventricle; *C*, area of softening; *D*, degenerated white matter at the base of the second parietal convolution; *E*, area of degeneration continuous with *A* and *B*; *F*, degeneration of white matter.

callosum was lacking. He believed that the fibers were all present but did not extend from one side of the brain to the other. It was in the nature of heterotopia and had therefore no important bearing on the subject.

Marchand (7) too believed that the fasciculus occipito-frontalis in agenesis of the corpus callosum did not correspond to a normal bundle in that situation but rather to the fibers which existed normally in the corpus callosum.

Obersteiner and Redlich (8), Schröder (9), Bischoff (10), Römer (11) and Probst (12) also looked upon this bundle as being abnormally situated fibers belonging to the corpus callosum.

While Römer described a bundle of fibers corresponding to the fasciculus occipito-frontalis in horizontal section he was unable to trace a long association bundle in sagittal sections similar to this bundle of fibers and concluded that the findings of Onufrowicz, Kaufmann and others forming the basis for Dejerine's claim for the "faisceau occipito-frontal" were insufficient.

Von Monakow (13) described a bundle similar to the "faisceau occipito-frontal" of Dejerine, and the "reticulo-cortico-Bundle" of Obersteiner and Redlich. The latter authorities proposed the name of "reticulirtes cortico-caudales Bündel" which collects projection fibers from the cortex to the caudate nucleus and which continues as a small bundle into the inferior horn of the lateral ventricle. This bundle consists of large fibers situated somewhat in front of the caudate nucleus and extends backwards lateral to the caudate nucleus.

Zingerle (14) claimed to have demonstrated in his case in which the corpus callosum was only present in its anterior portion corresponding to the knee of the corpus callosum, the presence of a long association system between the frontal, parietal and occipital regions, analogous to the fronto-occipital bundle of Onufrowicz and the fasciculus subcallosus of Muratow. Schröder did not believe that this case was analogous to those of Kaufmann, Onufrowicz and Hochhaus, which were cases of defective development while that of Zingerle was one of softening and atrophy.

As the result of experiments upon animals, Muratow (15) concluded that the fasciculus occipito-frontalis of Onufrowicz and Kaufmann, called by Muratow the fasciculus sub-callosus,

is a long association bundle which degenerates in the same hemisphere in which the frontal or occipital lobe has been destroyed. After the corpus callosum was cut in his animals, there was no degeneration found in the tapetum nor the fasciculus subcallosus. He did not believe that in the fasciculus subcallosus, the fibers extended throughout the entire system.

Obersteiner and Redlich, as the result of experiments, concluded that the fasciculus subcallosus, which, in their opinion was identical with the "faisceau nuclei caudati" of Sachs, had nothing whatever to do with the fasciculus occipito-frontalis of Onufrowicz, but that this bundle consisted of fibers of the corpus callosum in all probability.

The fasciculus occipito-frontalis, as described by Dejerine, Obersteiner and Redlich, is recognized as a narrow bundle that can be differentiated in man but not in animals. The fasciculus subcallosus of Muratow found in animals probably corresponds to the "substance grise sous-épendymaire" of Dejerine in man, in their opinion.

According to Obersteiner and Redlich a bundle, the size and thickness of the so-called fasciculus occipito-frontalis in a brain lacking the corpus callosum, does not exist in a normal brain.

Sachs (16) stated that a bundle of fibers corresponding to the "faisceau occipito-frontal" of Dejerine, extended vertically in the direction of the corona radiata lateral to the fasciculus nuclei caudati and above the caudate nucleus and that these fibers according to Wernicke came from the knee of the corpus callosum and entered the internal capsule.

Anton (17) described the brain of a three and a half year old boy in which the corpus callosum was absent in the anterior third and posteriorly consisted of a thin layer which did not unite in the median line. In this brain he found a fronto-occipital association system in the roof and the outer wall of the ventricle, which was situated medially from the corpus callosum and which sent fibers to the anterior limb of the internal capsule.

Tapetum.—The relation that the tapetum holds to the corpus callosum and the fasciculus occipito-frontalis also is a matter of dispute.

There are some authors who claim that the tapetum is in large part or entirely made up of fibers from the corpus callosum.

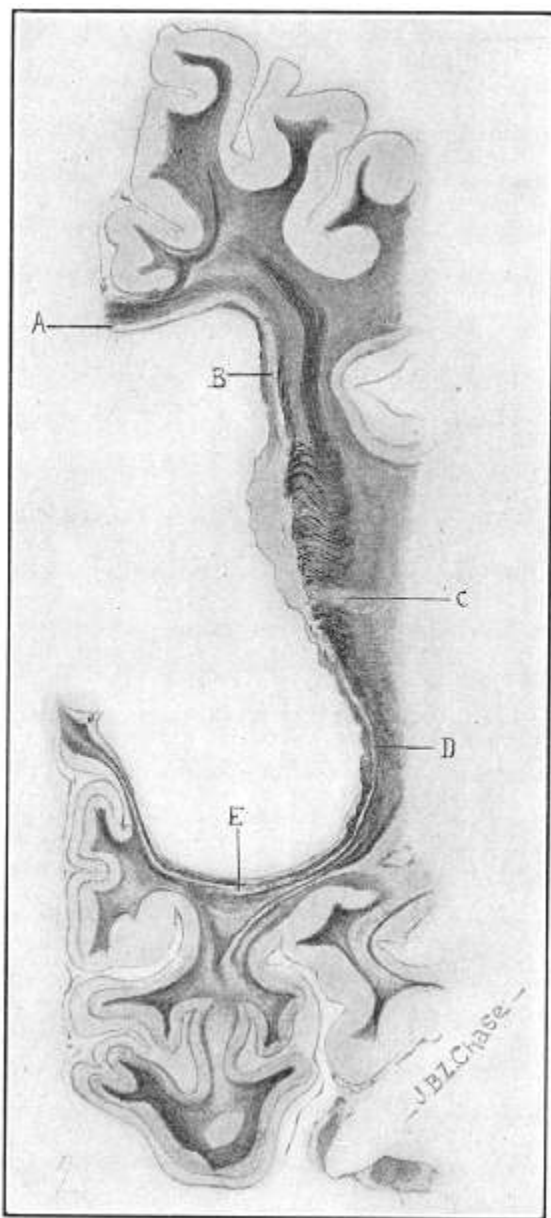


FIG. 2. (Right side.) *A*, area of degeneration in the knee of the corpus callosum; *B*, degenerated fasciculus occipito-frontalis; *C*, degeneration in the white matter secondary to the necrotic area in Fig. 1; *D* and *E*, degenerated area taken to be part of the fasciculus occipito-frontalis.

Monakow believed that the tapetum is made up of fibers from the corpus callosum as well as the fasciculus occipito-frontalis and fasciculus nuclei caudatis.

Obersteiner and Redlich believed that the tapetum which Burdach described as occupying the lateral side of the inferior horn of the lateral ventricle has nothing to do with the fasciculus occipito-frontalis and they recommend that the expression tapetum be abolished and that this layer be referred to as the "stratum subcallosum" or "Balkenschicht."

The tapetum as designated by Burdach (Sachs) is that part of the corpus callosum which extends to the outer side of the lateral wall of the ventricle and then forward into the temporal lobe. All that part of the corpus callosum which extends into the occipital lobe he designated as the forceps. Sachs stated that according to the newer conception of the subject, that part of the corpus callosum which is found on the outer side of the posterior horn is called the tapetum. The posterior fibers that bend forward and go to the temporal lobe form the end of the tapetum, while those fibers which before they run downwards, go for a short distance in the upper part of the forceps, belong to the forceps and form the anterior part of the ascending layers of fibers that go to the outer side of the posterior horn.

Anton (in Obersteiner) has shown in a case in which there was softening of the splenium and forceps major, secondary degeneration of the tapetum on the opposite side, and Vogt (18) claimed as the result of his studies, that the tapetum contained fibers from the corpus callosum, while Beevor (19) also believed that the tapetum is part of the corpus callosum.

Mingazzini (20) as the result of study of arrested development in the brain of an idiot in which the corpus callosum was implicated, doubted that the tapetum of "Trave" pertained to the fasciculus occipito-frontalis. Probst however, properly criticised this observation as it was one showing a lack of the corpus callosum besides extensive changes in the brain elsewhere, and did not believe that definite conclusions as to the anatomy of the tapetum were justified.

Probst was unable to trace fibers corresponding to the "faisceau occipito-frontal" of Dejerine, to the tapetum and concluded that the tapetum was composed exclusively, as was before stated, of the "Balkenlängsbündel," which he claimed is identical with the fasciculus occipito-frontalis of Onufrowicz.

On the other hand, Onufrowicz, Kaufmann and Hochhaus believed that their cases prove that the tapetum is independent of the corpus callosum and that it really belongs to the fasciculus occipito-frontalis.

Muratow's experiments showed that the fasciculus subcallosus and the tapetum belong to one and the same system and he believed that little or no relation existed between the tapetum and the corpus callosum.

In this connection the experiments of Bianchi (21) upon apes have a distinct bearing, as he was not able to trace the degeneration of the fasciculus occipito-frontalis behind the parietal operculum. Dejerine believed that there is little or no relation between the tapetum and the corpus callosum, and Forel claimed that the fibers of the so-called tapetum did not belong to the corpus callosum but were association fibers of one hemisphere. He believed that that part of the corpus callosum tapetum going to the posterior horn belonged to the fasciculus occipito-frontalis of Forel.

The tapetum does not, according to Edinger (22), enter into the formation of the corpus callosum and he considered the tapetum, the posterior radiation of the fasciculus occipito-frontalis.

The case to be described below offered an unusual opportunity to study the relation which the tapetum holds to the fasciculus occipito-frontalis, inasmuch as there was present in the brain a hemorrhage which cut the tapetal fibers on one side, though to a somewhat limited extent. The other lesions in the brain were such as not to confuse the findings and permitted, I believe, definite conclusions to be drawn. The findings were so radically different in some respects, though confirmatory in others of the facts already described, that the conclusions are put forth conservatively and with some hesitation. The case has already been reported but not in this connection.

From the history of this case the hemorrhage evidently antedated death thirty-one months, thus giving ample time for secondary degeneration to become complete.

There was a hemorrhage in the outer and posterior wall of the descending horn of the lateral ventricle on the right side. The upper limit of this hemorrhage was observed as a fine line in the white matter of the posterior and external portions of the

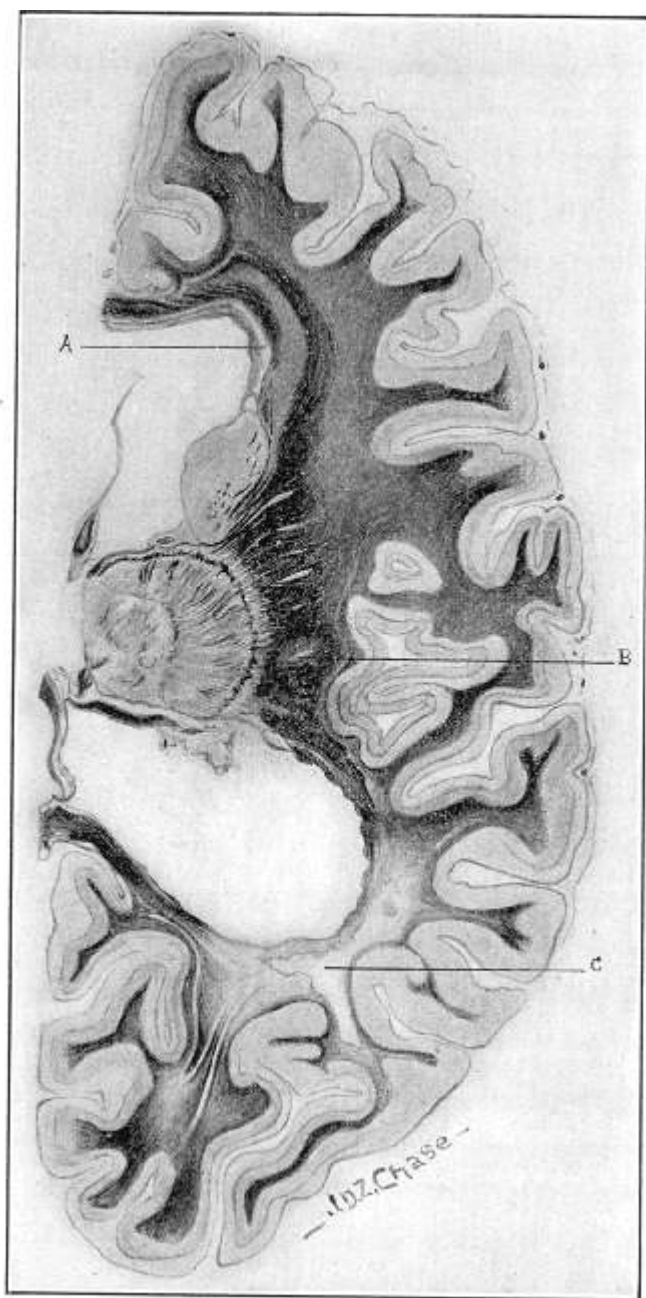


FIG. 3. (Right side.) *A*, degenerated fasciculus occipito-frontalis; *B*, degeneration in the posterior segment of the internal capsule secondary to the necrotic area in Fig. 1; *C*, hemorrhage involving the fasciculus longitudinalis inferioris and optic radiations of Gratiolet and tapetum.

occipital convolutions in the upper levels of the brain, corresponding to about the level where the caudate nucleus first makes its appearance in horizontal sections.

In sections just below this the hemorrhage was more extensive, involving the white matter of the posterior part of the corona radiata and extending forward to the posterior external angle of the distended lateral ventricle to within 3 mm. of the wall of the ventricle.

In the sections a little lower, the hemorrhage destroyed all the white matter between the tapetum and the gray matter of the first temporal and lower parietal convolutions, where it extended on each side of the inter-parietal fissure.

At the next level the optic thalamus appears in the section, the internal capsule is well formed, and the tail of the caudate nucleus is very small. Here the hemorrhage has involved all the white matter between the gray matter of the second parietal and first temporal convolutions and the descending horn of the lateral ventricle which is much distended (Fig. 3, *c*). The distance from the wall of the lateral ventricle to the cortex at this level is 2.5 cm. The white matter at this level measures 7 mm. in width, and is entirely destroyed by the hemorrhage, which extends from its anterior to its posterior limits a distance of 2.5 cm. It is at this level that the tapetum is implicated in the hemorrhage.

The lower limit of the hemorrhage is at a level where the red nucleus first begins to make its appearance. The lateral ventricle is very much distended and the white matter at the base of the third temporal convolution between the ventricle and the gray matter, measures one to three millimeters. This level corresponds to Fig. 231 in Dejerine, which passes 72 mm. below the superior border of the hemisphere.

While this lesion forms the basis for the anatomic study of the tapetum and fasciculus occipito-frontalis in this paper, mention should be made of a small area of softening (Fig. 1 *c*) which is observed in the white matter of the corona radiata in its middle portion, just internal to the fissure of Rolando on the right side. This necrotic area measures in its lateral diameter 1 cm., in its anterior posterior diameter 2 mm. and it extends in a vertical direction for about 3 mm. It is situated 3 cm. below the superior border of the right hemisphere about its middle portion.

In addition to this there is a third hemorrhagic area in the

left optic thalamus. It is only the first hemorrhage, however, that has any bearing upon this study.

The entire brain was cut in serial sections. Of these, 28 on the right side and 15 on the left side were selected for description.

In section no. 1 (see Fig. 1) the level corresponds to Fig. 219 in Dejerine except that at this level the much distended lateral ventricle appears in the section. The occipito-frontal bundle stains less distinctly than normal and is evidently degenerated. This degeneration is continuous with a bundle of fibers which takes the stain less distinctly than normal, and which can be traced into the corpus callosum and around to the inner side of the ventricle, and thence backwards until it joins a band of degeneration which skirts the posterior part of the lateral ventricle, and which then extends forward in the external wall of the lateral ventricle to join the degenerated area anteriorly, in the position occupied by the "*faisceau occipito-frontal*" of Dejerine (Fig. 1, *A-B, E*).

The white matter at the base of the second parietal convolution stains very poorly and this is also true of the white matter of the second parietal convolution itself (Fig. 1, *D*). The fasciculus longitudinalis superioris appears to stain less deeply than normal as far forward as the white matter of the frontal lobe.

At this level to be emphasized then is the fact that more or less distinctly can be traced a band of degeneration surrounding the lateral ventricle and adjacent to its walls, and also the presence of degenerated white matter of the two parietal convolutions which is connected with a white line of degeneration situated at the base of the second parietal convolution just internal to the interparietal fissure, which appears in the midst of the fasciculus longitudinalis superioris and which can be traced along this bundle to the frontal lobe. The white matter here between the interparietal fissure and the wall of the ventricle measures less than a half a centimeter.

The fibers in the region of the fasciculus occipito-frontalis are not totally degenerated evidently as they take the stain to a certain extent.

A little lower than this level however, the band of degeneration surrounding the lateral ventricle can only be followed on the inside of the ventricle as far back as the posterior fifth, and on the outer side of the ventricle to the second fifth of the distended lateral ventricle. It is still marked however in the posterior wall of the ventricle.

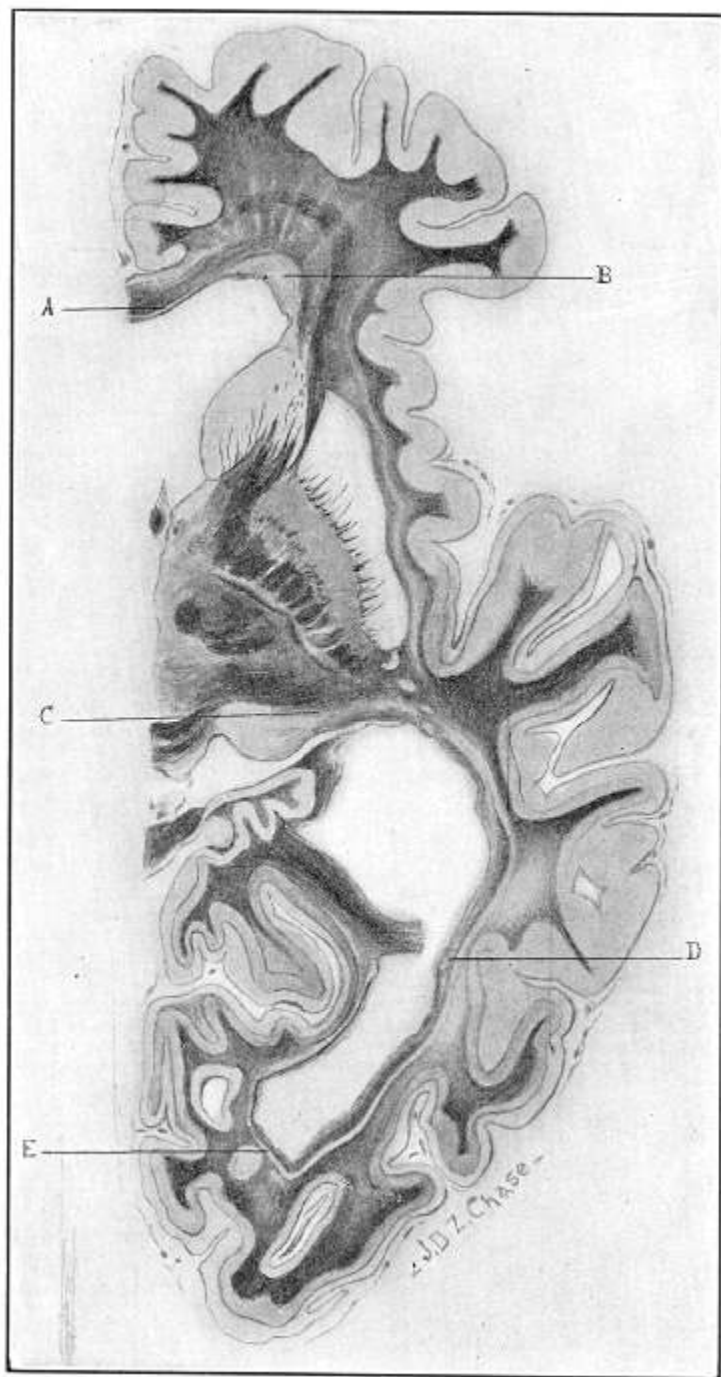


FIG. 4. (Right side.) *A*, degeneration of the corpus callosum; *B*, degeneration of the fasciculus occipito-frontalis; *C*, degeneration of fibers from the frontamer; *D*, lowest level of the hemorrhage; *E*, degenerated area continuous with the degenerated fasciculus longitudinalis inferioris.

In section no. 5 (see Fig. 2) the caudate nucleus just begins to appear in horizontal section. At this level the fronto-occipital fibers stain poorly and are continuous with a degenerated bundle which extends across the corpus callosum to the median line just forward of the anterior ventricular wall. There are between the wall of the ventricle and the area of degeneration, normally staining fibers which give the appearance of a dark narrow line in this region. Posteriorly there is a band of degeneration which can be traced from the border of the caudate nucleus backwards and around the lateral ventricle and forward again into the splenium. This is a fine line and there is between it and the wall of the ventricle a fine band of well-stained fibers.

The white matter of the occipital lobe is degenerated and this degeneration can be traced forward and outward to join the hemorrhagic softening above described as occupying the white matter at the base of the second parietal convolution.

The white matter of the first limbic lobe is also degenerated.

Section no. 6 (see Fig. 3) corresponds to Fig. 222 in Dejerine which passes 48 mm. below the superior border of the hemisphere. At this level the three nuclei of the optic thalamus make their appearance. The occipito-frontal fibers do not stain well and appear to be continuous with a band of degeneration which passes through the corpus callosum to the median line (Fig. 3, A). The external capsule stains poorly.

Just posterior to the tail of the caudate nucleus there extends for a distance of 2 cm. a band of degenerated fibers. It is at this level that the hemorrhage is most extensive and involves the entire white matter between the second parietal convolution and the wall of the ventricle at the posterior external angle of the ventricle, cutting at this level the fasciculus longitudinalis inferioris, the optic radiations of Gratiolet and the tapetum. Bands of degeneration are traced back into the occipital lobe and into the splenium from the necrotic area. Immediately forward of it, the white matter takes the stain fairly well with the exception of the small band of degeneration described above as extending posterior to the tail of the caudate nucleus.

In sections nos. 10 and 11 the degeneration can be traced in the white matter of the temporal lobe and the first occipital lobe. The fasciculus longitudinalis inferioris and the optic radiations of Gratiolet are both degenerated, but this cannot be traced as far

forward as the internal nucleus of the optic thalamus. The tapetum is degenerated at this level. The white matter of the first temporal convolution and superior parietal convolution as well as the white matter just posterior to the posterior wall of the descending horn of the lateral ventricle is degenerated.

Beginning rather suddenly just beyond the hemorrhagic area, the fasciculus longitudinalis inferioris and the optic radiations of Gratiolet stain well and appear to be normal as far forward as the internal nucleus of the optic thalamus, but these bundles posterior to the hemorrhage are degenerated as far back as the posterior pole of the second occipital convolution. The internal capsule stains well except at one portion in the posterior segment of the internal capsule.

Section no. 14 corresponds to Fig. 224 in Dejerine which is 55 mm. below the superior border of the hemisphere. At this level two of the nuclei of the lenticular nucleus appear in the section.

Degeneration of the fasciculus longitudinalis inferioris and optic radiations of Gratiolet can be traced from the putamen backwards and outwards to join the area of degeneration at the base of the anterior portion of the two temporal convolutions. The tapetum at this level stains well. The white matter of the occipital lobe is not degenerated except for a band of degeneration at the posterior limit of the posterior horn which extends forward on either side of the posterior horn for a short distance, connecting on the external side of the ventricle with the hemorrhagic focus. The occipito-frontal fibers at this level are undoubtedly degenerated and appear still to be continuous with the degenerated band extending to the median line of the corpus callosum.

In section 16 there is a small necrotic area in the optic thalamus, just internal to the "zone réticulée" and nine millimeters in front of the posterior border of the optic thalamus.

In section no. 20 (see Fig. 4), Fig. 227 in Dejerine, the degeneration is still seen in the internal capsule faintly. The fasciculus occipito-frontalis stains better than in the levels above, though is evidently degenerated still. In the optic thalamus there is found a small almost microscopic hemorrhage in the internal medullary layer ("lame médullaire interne") which is evidently a continuation of the hemorrhage described in section no. 16.

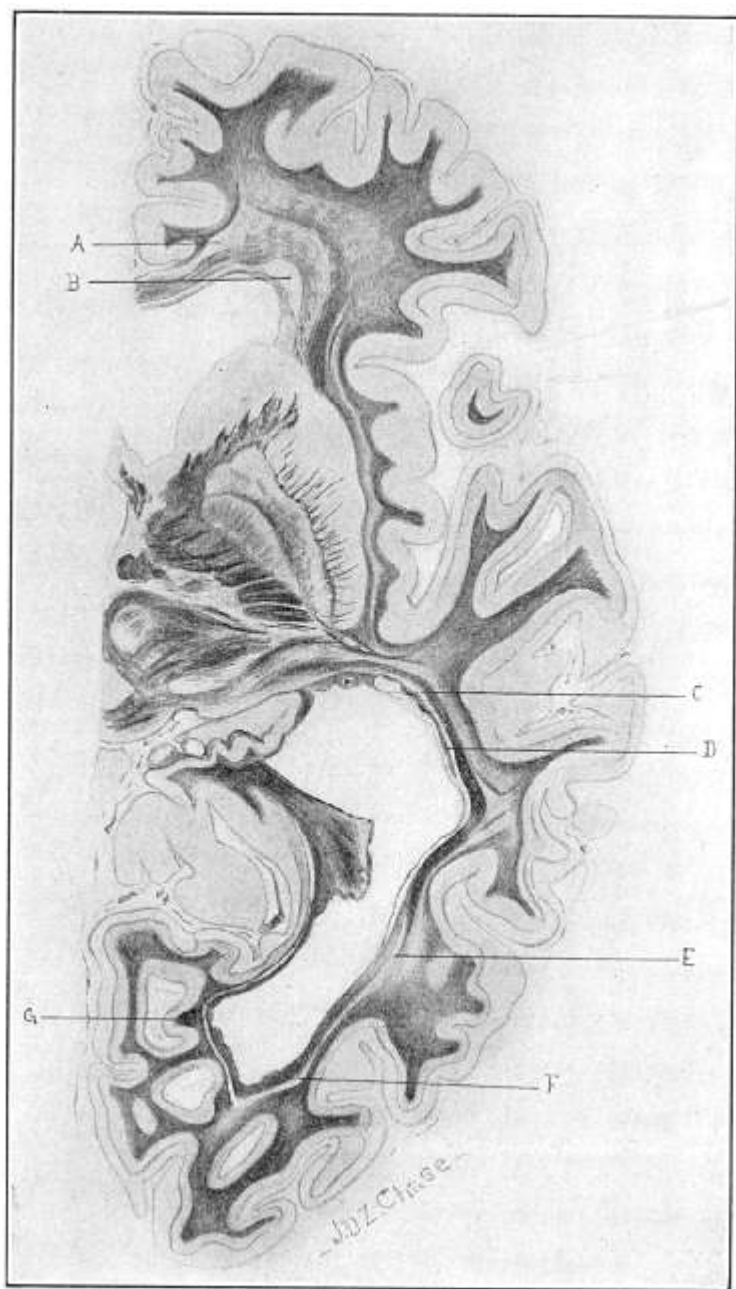


FIG. 5. (Right side.) *A*, degeneration of the white matter of the frontal lobe which can be traced into the corpus callosum; *B*, degenerated fasciculus occipito-frontalis; *C*, degenerated optic radiation of Gratiolet; *D*, tapetum which shows some degeneration; *E*, degeneration of the fasciculus longitudinalis inferioris and optic radiation of Gratiolet; *F* and *G*, degenerated area continuous with the degeneration found at *E*.

No degeneration could be traced from this area to the internal capsule.

At the posterior part of the first temporal convolution the optic radiations of Gratiolet and the fasciculus longitudinalis inferioris stain faintly for a space of about two centimeters. Anteriorly from this however, as far as the putamen, they stain very little. Posteriorly these bundles stain very poorly as far as the area of softening which, at this level is very small and at which point the distance between the gray matter of the cortex and the ventricle is but 2-3 mm. The white matter of the posterior part of the first temporal convolution and the anterior part of the second temporal convolution is much degenerated. From the area of softening posteriorly there is a band of unstained fibers which surround the posterior wall of the inferior horn of the lateral ventricle, and this can be traced forward into the forceps minor.

The white matter of the cuneus is slightly degenerated as is also the cuneo-limbic gyrus. The degeneration in the latter can be traced around the posterior wall of the lateral ventricle and forward to the point at which the calcarine fissure unites with the parieto-occipital fissure, where it joins the degenerated area in the forceps minor traceable to the fasciculus longitudinalis inferioris. The tapetum is small, stains faintly and is evidently somewhat degenerated.

At section no. 22 (see Fig. 5) corresponding to Fig. 229 in Dejerine, the internal and external geniculate bodies and the pulvinar appear to be smaller than on the left side. The fasciculus longitudinalis inferioris and the optic radiations stain fairly well as far back as the third occipital convolution, when quite suddenly they cease to stain, more especially the fasciculus longitudinalis inferioris. The tapetum is degenerated at this level, though posterior to the tail of the caudate nucleus it stains fairly well for a distance of about two centimeters.

The fasciculus occipito-frontalis does not stain well here, and degeneration can be traced forward to the median line in the knee of the corpus callosum.

The white matter of the third occipital convolution stains poorly, and the white matter of the cornu ammonis is degenerated. The degeneration in the fasciculus longitudinalis inferioris extends forward but cannot be traced into the cornu ammonis, but a little below this level it is possible to do so.

In section no. 25, the level corresponds to Fig. 230 in Dejerine, which is 70 mm. below the superior border of the hemisphere. The commissure of Meynert is intact as well as the internal geniculate body. Wernicke zone is apparently normal as is also the anterior commissure. The internal capsule shows a slight area of degeneration still. At the second occipital lobe the white matter is degenerated and also the white matter of the lingual lobe, which seems to be continuous with the degeneration in the occipital lobe. The fasciculus longitudinalis inferioris and the optic radiations stain very well as far back as the beginning of the second occipital lobe and suddenly then cease to stain. The tapetum is degenerated at this level, beginning about 1 cm. posteriorly to the caudate nucleus, forward of which the fibers take the stain fairly well though evidently the bulk of the tapetum is diminished.

In section no. 28 (see Fig. 6) the fasciculus longitudinalis inferioris stains fairly well up to the base of the second temporal convolution, then for a space of 1.5 cm. stains poorly. Forward posterior to the tail of the caudate nucleus the optic radiations are degenerated for a distance of 2 cm. Then a fine line of degeneration can be followed from this point backwards around the posterior horn and thence forward into the cornu ammonis. The tapetum at this level is almost entirely degenerated except for about a distance of 1.5 cm. posterior to the caudate nucleus. Just above this level the fasciculus longitudinalis inferioris and the optic radiations are almost completely degenerated.

In sections nos. 31 and 32, corresponding to Figs. 230 and 231 in Dejerine, there is some degeneration of the second temporal convolution. The fasciculus longitudinalis inferioris stains well at this level, and the optic radiations stain fairly well from the external geniculate body backwards to the beginning of the second occipital lobe. Here the staining suddenly becomes poor and a narrow band of degeneration can be followed posteriorly around the posterior horn and forward into the lingual lobe. The tapetum at this level is degenerated.

Left Side.—In the uppermost levels no pathological change can be observed.

In section no. 1 (see Fig. 7) a degenerated tract can be seen in the corpus callosum corresponding to a similar area of degeneration on the right side, and this can be traced into the fasciculus

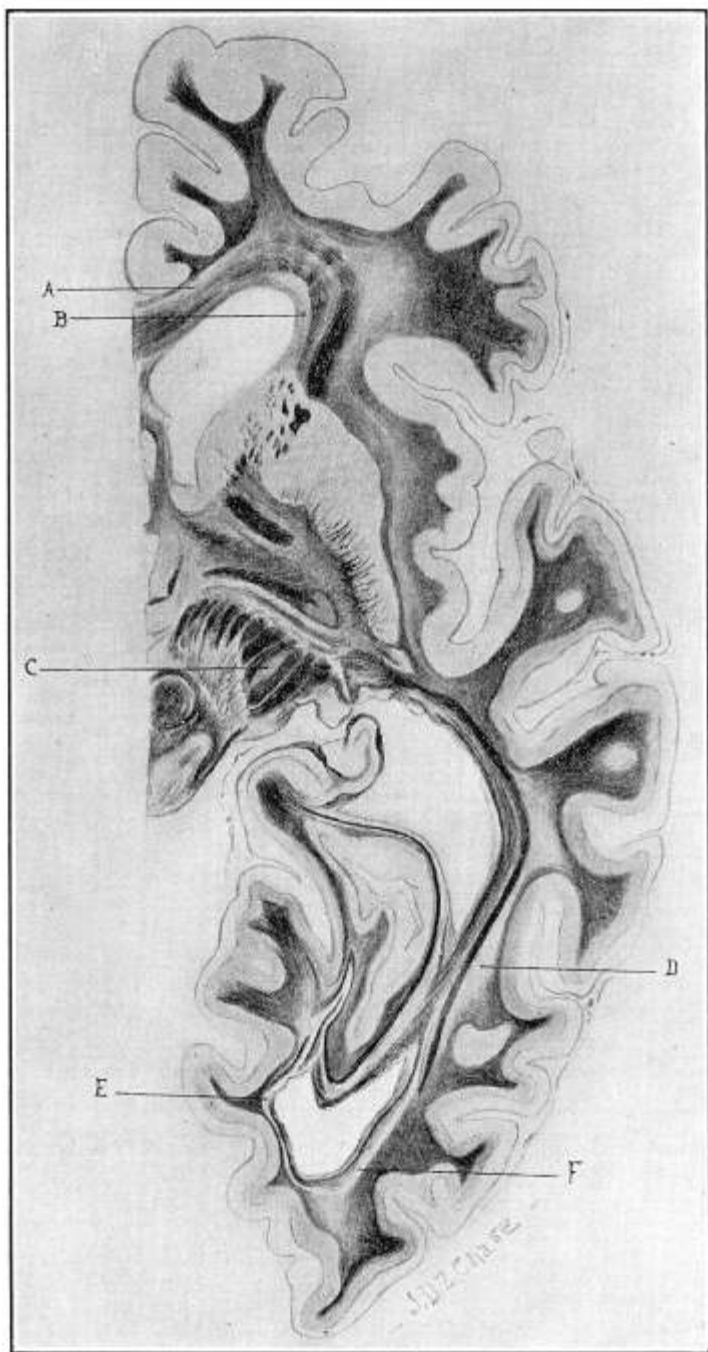


FIG. 6. (Right side.) *A*, degeneration in the corpus callosum arising apparently in the frontal lobes; *B*, degenerated fasciculus occipito-frontalis; *C*, secondary degeneration in the foot of the peduncle; *D*, degeneration in the white matter of the second temporal convolution; *E* and *F*, degenerated area continuous with the degeneration of the optic radiation of Gratiolet.

occipito-frontalis. Farther forward in the corpus callosum is a tract of degeneration which can be traced forward into the frontal lobe.

At a little lower level (see Fig. 8) the same condition is observed. Posteriorly here, however, in the corpus callosum there appears to be some degeneration extending from the opposite side to the tapetum. This degeneration cannot be traced at a lower level than that corresponding to Fig. 223 in Dejerine.

In section no. 6, the optic thalamus is the seat of an area of necrosis situated in about its middle portion. The fasciculus longitudinalis inferioris is slightly degenerated and the optic radiations of Gratiolet do not stain as well as normally in the posterior outer angle of the lateral ventricle.

In section no. 9, which is still lower and in which the three divisions of the lenticular nucleus, the red nucleus in the pons, and the anterior commissure, are seen corresponding to about Fig. 228 in Dejerine, the degeneration in the optic radiations of Gratiolet is more marked.

In section no. 15 the fasciculus occipito-frontalis is degenerated slightly, and this degeneration can be traced forward into the corpus callosum. The optic radiations of Gratiolet are somewhat degenerated at this level.

Résumé.—In the upper levels on the right side is a band of degenerated fibers more intense in the posterior wall of the lateral ventricle, which can be traced to the hemorrhage in the levels below which destroys the tapetum to a certain extent. This band of degenerated fibers is continuous with a faint line of unstained or poorly stained white matter which at the uppermost levels surrounds the lateral ventricle, leaving a band of well stained white matter between it and the ventricular wall. Forward and in the outer wall of the ventricle this band corresponds to the position of the fasciculus occipito-frontalis as described in Marburg's (23) atlas recently published (Fig. 71, *rcc*).

At a little lower level this band cannot be traced all around the ventricle but is present still to a marked degree in the posterior wall of the lateral ventricle.

These areas of degeneration, I believe, may be probably interpreted as being fibers of the fasciculus occipito-frontalis which have been pushed to the side by the distension of the ventricle.

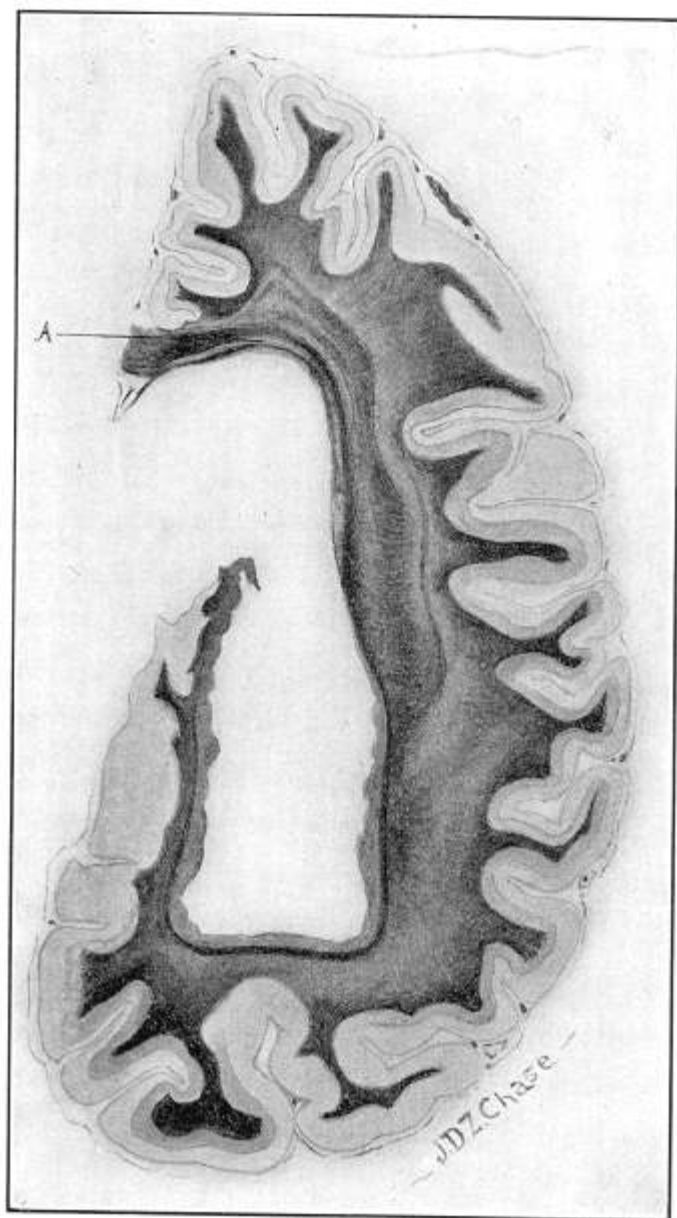


FIG. 7. (Left side.) *A*, degeneration in the corpus callosum.

At levels still lower the fasciculus occipito-frontalis is undoubtedly degenerated, and the unstained bundle of fibers can be traced into the corpus callosum as far as the median line, and when the same level on the left is studied this can be followed into the fasciculus occipito-frontalis on this side.

What appears to be degeneration can be traced into the splenium on the right side, but what the fate of these fibers on the opposite side is cannot be determined. Probably though, they extend into the tapetum of the left side, as in one section the tapetum was degenerated and degenerated fibers could be seen in the splenium.

There is little doubt that the degeneration of the fasciculus occipito-frontalis can be directly traced to the degenerated tapetum on the right side. That the degeneration in the corpus callosum is continuous with the degeneration in the fasciculus occipito-frontalis seems more than probable. This finding is uniform in a great many sections, and in comparison with sections from another brain recently studied, it appears to be undoubtedly abnormal.

These findings support the views of those who claim that the tapetum is a part of a long association bundle connecting the frontal and occipital lobes. Whether the tapetum is made up exclusively of fibers from the fasciculus occipito-frontalis or in part from the corpus callosum cannot be definitely stated from the findings in this case, in spite of the fact, that degenerated fibers could be found in the splenium directly traceable to the original hemorrhagic focus, since the white matter of the occipital and temporal lobes was implicated as well.

In conclusion, it seems probable that there is a long association bundle corresponding in position to the "faisceau occipito-frontal" described by Dejerine, of which the tapetum is a part, and which sends some fibers across the knee of the corpus callosum to the fasciculus occipito-frontalis of the opposite side.

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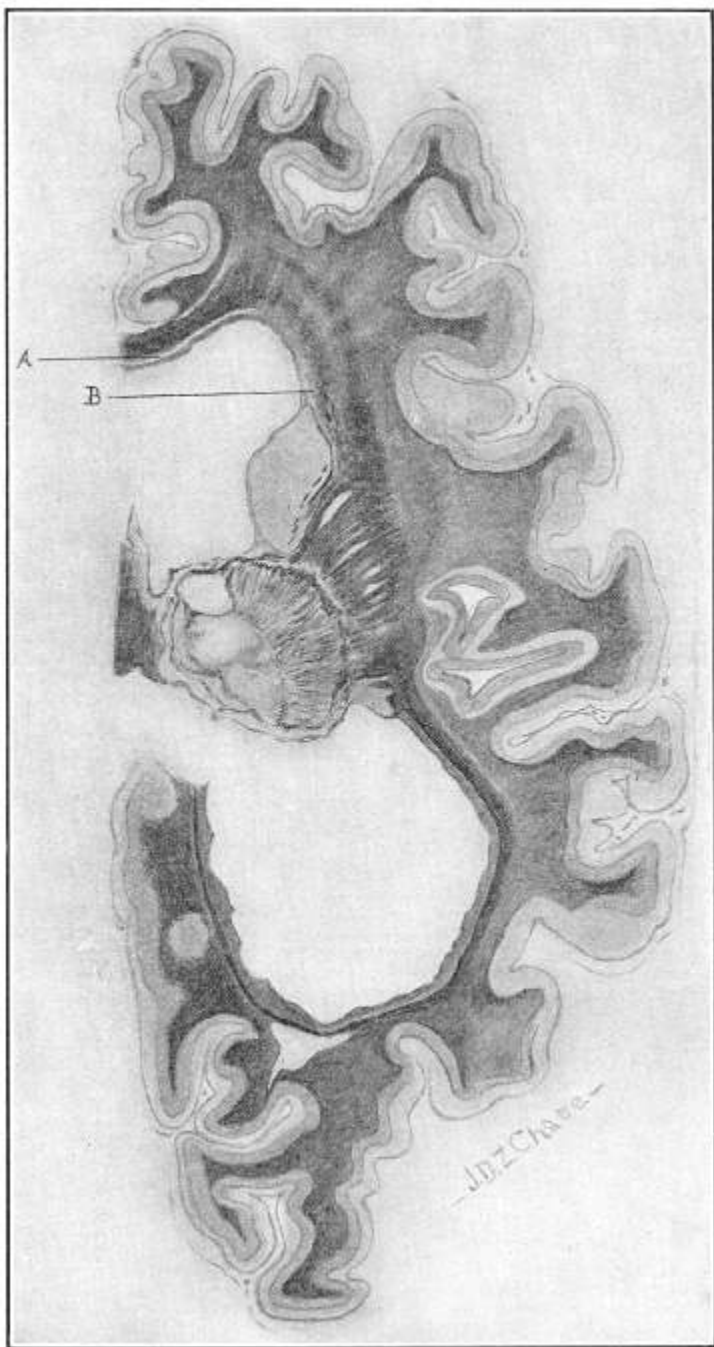


FIG. 8. (Left side.) *A*, degenerated area in the corpus callosum which can be traced to *B*, degenerated fasciculus occipito-frontalis.

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