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Photometric studies on the myeloarchitecture of the human parietal lobe

I. Parietal region

By

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with 19 figures

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Architectonic descriptions which are based on the study of one brain only are of limited value. Although most investigators of architectonics have studied several brains, they have published only photographs and maps of one brain because of the limited space offered by most of the periodicals. This was and is a great hindrance in this special field of neuroanatomy since the constancy of architectonic findings is often questioned.

In the author's opinion, myeloarchitectonics is a suitable and reliable method for quick orientation within the cerebral cortex. Most of the myeloarchitectonic areas can be distinguished by macroscopic observation. But a more general acceptance and use of myeloarchitectonics will only be possible if its constancy and reliability are proved.

The first step on this way was to find out which myeloarchitectonic features are constant, that means independent of the direction of cutting and of the inevitable variations of the staining process. It was found (HOPF 1954a—c) that the behaviour

of the horizontal stripes of BAILLARGER in comparison with each other and with the other sublayers is the most valuable criterion. One can easily observe the horizontal stripes with the naked eye. The thickness of the layers on the other hand, is of limited value because it may vary with the direction of cutting.

Some years ago, the only possibility of stating the constancy of architectonic features was the photographic documentation of the same area of various brains. This was done for the myeloarchitectonic areas of the postcentral cortex (preparations from 9 hemispheres of normal and pathological brains) and of the cortex of the temporal pole (8 hemispheres) (HOPF 1954b).

In another paper (HOPF 1954c) the differences between the upper and lower parietal lobule were photographically recorded for the cytoarchitecture (7 hemispheres) and for the myeloarchitecture (31 hemispheres) as well as for the differences between the first and second temporal gyrus (cytoarchitecture: 8 hemispheres; myeloarchitecture: 26 hemispheres).

The architectonic differences between the upper and lower parietal lobule as well as between the first and second temporal gyrus have been questioned by BAILEY and v. BONIN (1951). Their criticism has been rather widely accepted, although they have studied only one hemisphere of a human brain *cytoarchitectonically*. Nevertheless, these authors have also strongly criticized the myeloarchitectonic method.

In 1965 a new method for objective registration of myeloarchitectonics was developed in order to prove the existence and constancy of the myeloarchitectonic types described by microscopic observation which inevitably was subjective to a certain degree.

This method allows the relative content in myelinated fibres of the various layers to be reliably registered. The method cannot determine absolute values of myelin because even a highly standardized myelin staining process is not a quantitative method. It is also not possible to differentiate between radial and horizontal fibre content. The method and its limitations have been described previously (HOPF 1965, 1966). The human frontal and temporal lobe were the first regions studied with this method in detail (HOPF 1968).

Myeloarchitecture of the human parietal lobe

Within the parietal lobe we distinguish, myeloarchitectonically, with BATSCH (1956), two regions, a parietal region, and a postcentral region, the latter of which is not included in this paper but will be discussed in another publication.

Previous Papers

CAMPBELL (1905) studied the human brain cytoarchitectonically as well as myeloarchitectonically. He described only one parietal area in the superior parietal lobule and a temporal region covering not only the temporal lobe (with the exception of the first temporal gyrus) but also the inferior parietal lobule. The map of CAMPBELL further shows a limbic area A on the posterior part of the gyrus cinguli. This part was included in the parietal region by VOGT (1911).

The studies of Elliot SMITH can also be regarded as myeloarchitectonic in nature. He could differentiate about 50 areas by macroscopic observation of fresh cortical sections, using mainly the distinctness of the horizontal stripes as a

characteristic. He found 3 areas (A—C) in the inferior parietal lobule which closely correspond to VOGT's 3 areas (88—90) in relation to their topography and extension. The same correspondence exists between the two superior parietal areas (A and B) of SMITH and of VOGT (areas 83 and 85).

The first detailed myeloarchitectonic subdivision of the isocortex parietalis was given by O. VOGT (1911). He found 21 areas which he numbered from 76—96¹⁾. But the description and denomination of the areas were unusual ones. Area 88, the most anterior area of the inferior parietal lobule e.g. was designated as area dives (that means rich in myelinated fibres) of the subdivisio typica of the divisio propeastriata (nearly without horizontal striping) of the subregio dyscingulata (layer 2 not sharply delimited from layer 3) of the regio euradiata (normal length of radial fibres).

Although this description is very precise for those who have a special training in myeloarchitectonics, it is surely not encouraging for all those who have not. VOGT's unique mode of description may be one of the reasons why myeloarchitectonics has not been applied more widely.

A more elaborate description of the myeloarchitecture of the human parietal lobe was given by BATSCH (1956). His subdivisions closely correspond to those GERHARDT (1940) found in her cytoarchitectonic studies. BATSCH distinguished in the regio parietalis 6 subregions with 21 areas (fig. 1). He used the numbering of VOGT and of GERHARDT. Some of these areas are further subdivided in more or less constant subareas labeled with Roman numerals or with letters indicating the topography²⁾.

The distribution of the main myeloarchitectonic features was demonstrated by special maps (HOPF and VITZTHUM 1957). A table indicating the correspondence of the architectonic areas of the various authors (CAMPBELL, SMITH, BRODMANN, VOGT, v. ECONOMO and KOSKINAS, ROSE, GERHARDT,

¹⁾ The numbers of the myeloarchitectonic areas of VOGT should not be confused with the different numbering of BRODMANN's cytoarchitectonic areas. VOGT's myeloarchitectonic areas 1—66 are situated in the frontal lobe and areas 67—75 on the postcentral gyrus and its operculum. But in their stimulation experiments of the monkey cortex, C. and O. Vogt (1919) used the numbering of BRODMANN, adding some Greek letters for a more detailed subdivision.

²⁾ a = anterior, m = medialis, p = posterior, ip = interparietal(is), o = occipital(is), t = temporal(is).

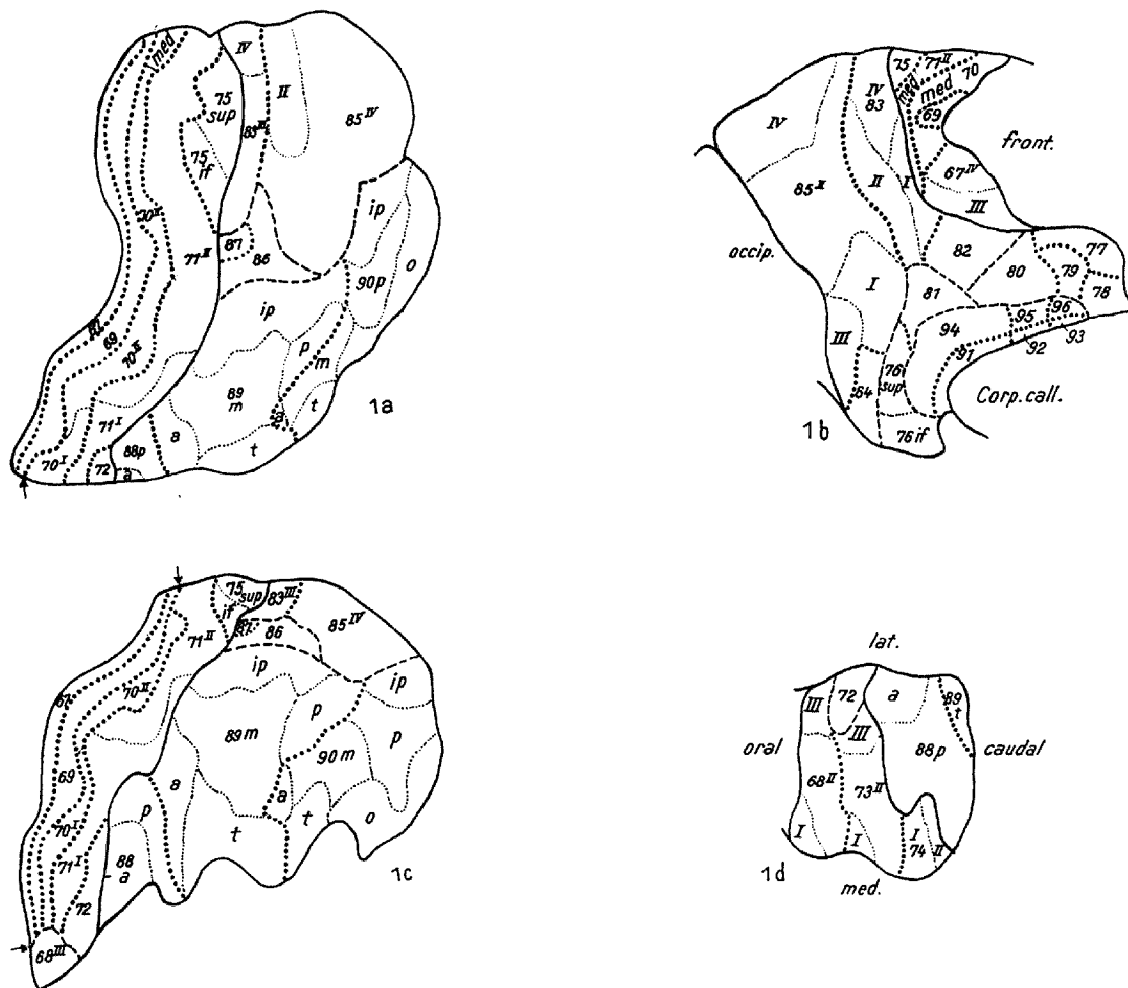


Fig. 1. Myeloarchitectonic map of the human parietal lobe (BATSCH 1956), modified by HOPF and VITZTHUM (1957).

— borders of regions
 - - - - - borders of subregions
 borders of areas
 borders of subareas

Subregio parietalis inferior = areas 88—90

Subregio parietalis intermedia = areas 86—87

Subregio parietalis superior-medialis = areas 82—85

Subregio parietalis paracingularis oralis = areas 77—80

Subregio parietalis paracingularis caudalis = areas 76 and 81

Subregio parietalis cingularis = areas 91—96.

a) Dorsal surface
 b) Medial surface

c) Lateral surface
 d) Opercular surface

BATSCH) was given in the same paper. A general survey of the architecture of the parietal lobe was published by VITZTHUM (1960).

Material and Method

Since all the brains do not stain equally, most of the figures and curves are taken from one brain and therefore directly comparable with one another. To prove whether the main features are constant, 8 hemispheres were examined. It is always marked if the pictures and curves are not from the standard brain.

Celloidin serial sections of a thickness of 40 μ , stained for myelin (Weigert-Wolters) are used, and for comparison, also paraffin sections of 20 μ , stained with the method of Woelcke.

3 cm wide photographic strips, orientated perpendicularly to the surface of the cortex, are taken of these sections at a magnification of 25:1. Only those parts of the cortex are suitable for registration where the layers are flat or only slightly curved. The photo negatives are developed under standardized conditions and evaluated with the extinction recorder of ZEISS.

The negatives were registered several times at intervals of up to 4 years and the curves were always exactly reproducible. The details of the method were published in 1966.

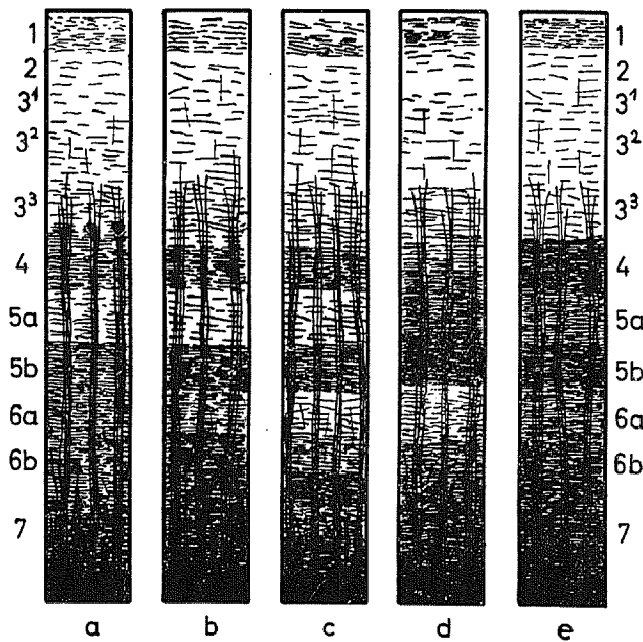


Fig. 2. Scheme of the myeloarchitectonic types of the parietal lobe. a) unistriate, b) propeunistriate, c) bistriate, d) unito- or conjunctostriate, e) propeastriate.

Results

Five main myeloarchitectonic types were found in the parietal region (fig. 2).

a) The unistriate type with only the outer stripe of Baillarger, in layer 4 clearly demarcated, but without a distinct inner stripe of Baillarger in sublayer 5b, because of the density of sublayer 6a.

b) The propeunistrate (nearly unistrate) type where the inner horizontal stripe of Baillarger in 5b is somewhat better demarcated since 6a is not quite as dense as 5b.

c) The bistriate type with very obvious outer and inner stripes of Baillarger and rather light sublayers 5a and 6a.

d) The unito- or conjunctostriate type¹⁾ with a dark sublayer 5a so that the two horizontal stripes of Baillarger are "united", and further characterized by a light sublayer 6a.

e) The propeastriate (nearly astriate) type with indistinct demarcation of the outer and inner stripes of Baillarger and rather dark sublayers 5a and 6a.

¹⁾ Vogt distinguished a unitostriate type where the darkness of sublayer 5a is mainly caused by thick „single fibres“ (Einzelfasern) and a conjunctostriate type with many thin myelinated fibres (Grundfasern) in this sublayer.

All the areas of the subregion parietalis superior-medialis are bistriate. There is a special small subregion parietalis intermedia in the neighbourhood of the intraparietal sulcus, the areas of which are darker than all the other areas of the parietal region. One of its areas (87) is conjunctostriate, the other (86) bistriate. This subregion belongs macroscopically to the superior parietal lobule. The subregion parietalis inferior is propeastriate.

In frontal sections through the anterior part of the parietal region, area 89 is situated below the intraparietal sulcus and the areas 87 and 86 above this sulcus (fig. 1). Are they constantly distinguishable?

Figure 3 shows area 87 on a small gyrus partially hidden in the upper wall of the intraparietal sulcus. The curve is typical for a conjuncto- or unitostriate type. There is an elevation in layer 4, corresponding to the outer stripe of Baillarger. No descent of the curve is seen in sublayer 5a. The elevation in 5b is very obvious and corresponds with the darker inner stripe of Baillarger. In 6a

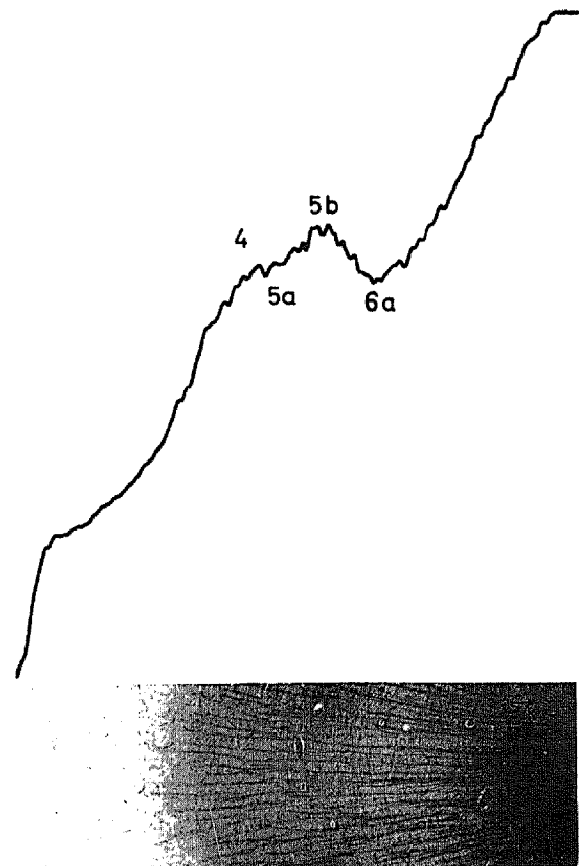


Fig. 3. Photomicrograph and corresponding extinction curve from the conjunctostriate area 87 of the intermediate parietal subregion. Original magnification $25\times$, reduced $\frac{4}{5} = 20\times$.

one sees quite an unusual descent of the curve. Sublayer 6a is lighter than sublayer 5a. This is very characteristic of the conjuncto- or unitostriate type and is not found in any other type (compare with figs. 3—7, 9—11). In all the other types sublayer 6a is much darker than 5a.

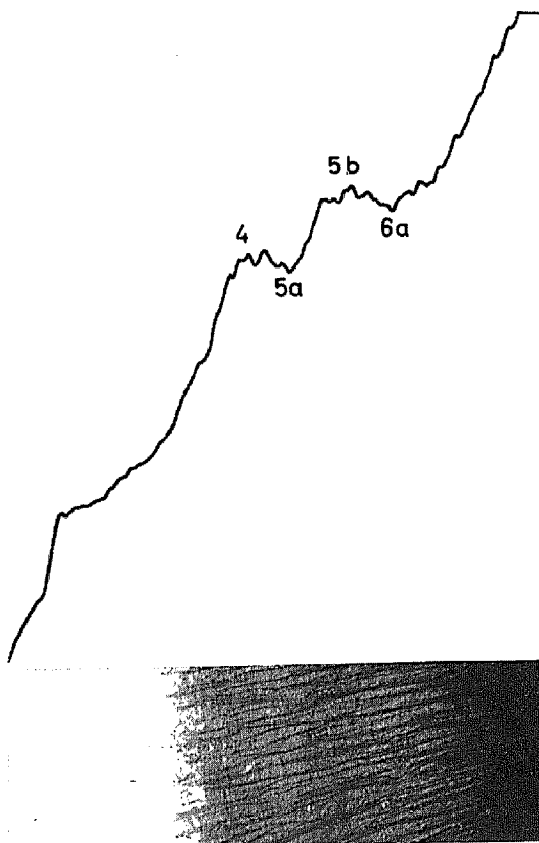


Fig. 4. Photomicrograph and extinction curve from the bistriate area 86 of the intermediate parietal subregion, 20 \times .

Figure 4 is taken from area 86. Both horizontal stripes of Baillarger are clearly demarcated. This is called a bistriate type.

The two photograms and curves in figure 5 are taken from subarea 89m of two different sections of the same brain. The curves show neither a continuous ascent, as in an astriate type, nor a descent in 5a and 6a, as in a bistriate type. The two horizontal stripes of Baillarger in 4 and 5b are not very obvious, but only indicated by a more horizontal course in the neighbouring sublayers 5a and 6a. This is characteristic of the propeastriate (nearly astriate) type. The two curves are very similar, though they are from different sections. In comparison with figure 4, the curves do not

ascend so steeply, and the plane between the baseline and the curve is not as large as in area 86. That means that the content in myelinated fibres is lower in area 89 of the inferior parietal lobule than in the area 86 of the superior parietal lobule (subregio interparietalis).

Subarea 89ip is situated between subarea 89m and area 86. Therefore its myeloarchitecture is expected to be "influenced" by both these neighbouring fields. 89ip belongs to the inferior parietal subregion, therefore, it is propeastriate (fig. 6). A slight descent of the curve is seen in 5a and 6a, showing in this way some relationship with the bistriate type of the upper parietal lobule

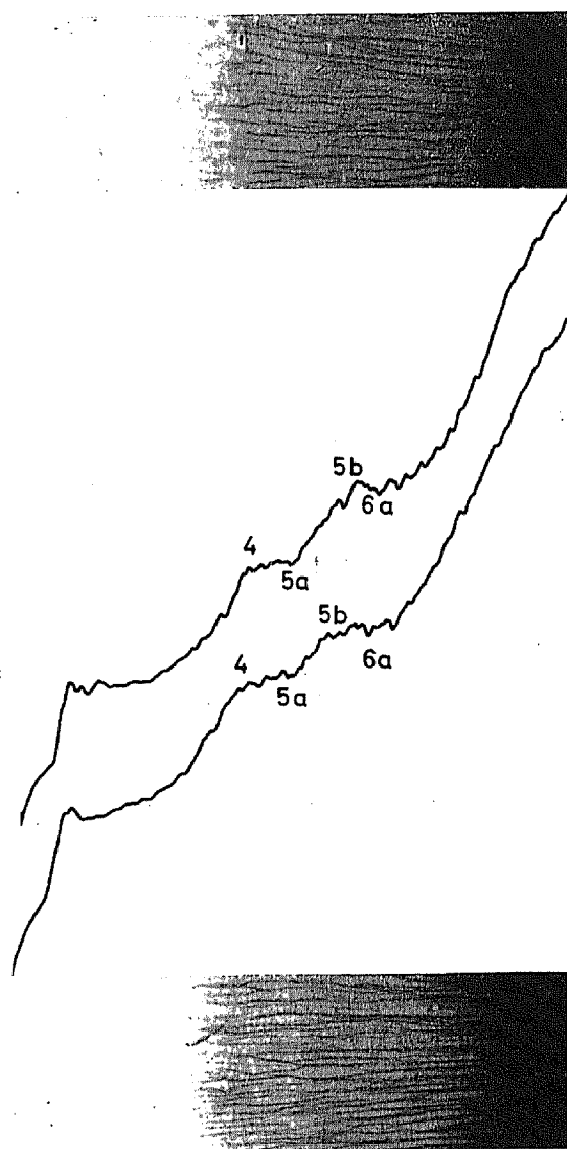


Fig. 5. Photomicrographs and curves from the propeastriate subarea 89m of the inferior parietal subregion from two sections of the same brain, 20 \times .

though being still distinct from this type. The curve ascends more rapidly, as in 89 m, but not so steeply as in 86. Its myelin content lies, therefore, between those of area 89 m and 86. This is a good example of the changes of architectonic features in steps, called "gradation" by VOGT.

The intermediate parietal subregion is followed in the dorsal (superior) direction by area 83 of the subregio parietalis superior-medialis (fig. 1). Area

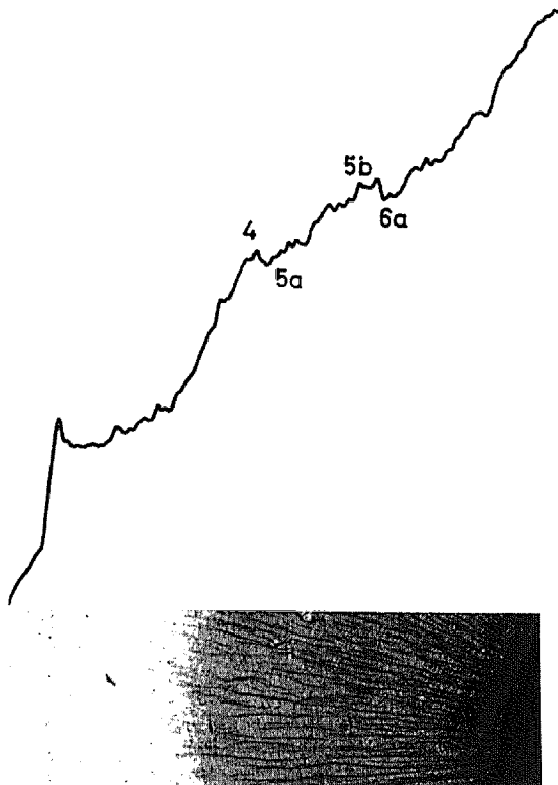


Fig. 6. Photomicrograph and extinction curve from the propeastriate subarea 89ip of the inferior parietal subregion, 20 \times .

83 (fig. 7) is bistriate as all the areas of the superior parietal lobule. Figure 8 shows the clearly defined border between 86 and 83. Area 83 is obviously less dense than 86.

The 7 curves of figure 9 are registered from the middle third of the inferior parietal lobules of 5 different hemispheres. No distinct horizontal striping is ever found, but a so-called propeastriate type. The curves show minor variations according to the varying topography (crown of a gyrus or wall of a sulcus) and to the different staining quality of the various brains. Furthermore, they are taken from different parts (subareas). The elevations in 4 and 5 b are a little more

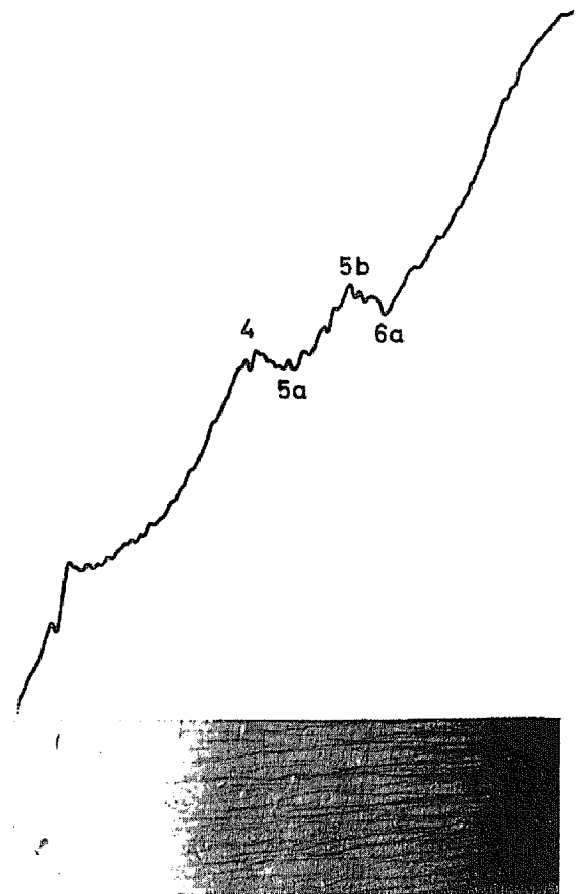


Fig. 7. Photomicrograph and extinction curve from the bistriate area 83 of the subregio parietalis superior-medialis, 20 \times .

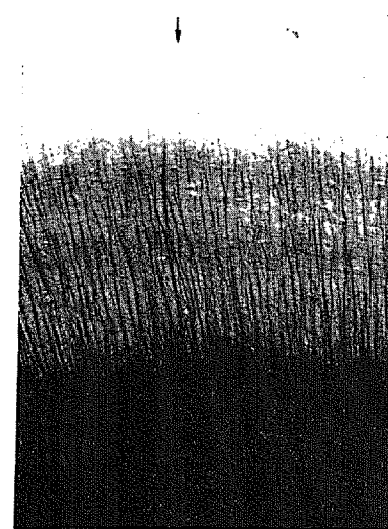


Fig. 8. Border (arrow) between 86 (left) and 83 (right), 15 \times .

distinct in the curves c—e, deriving from the cortex near the intraparietal sulcus (subarea 89ip). There is a constant difference between these

curves from area 89 of the inferior parietal subregion, and the curves from area 86 of the intermediate parietal subregion. The curves of figure 10

are from the latter subregion of the same hemispheres as in figure 9. The bistriate type is always obvious.

In figure 11 the lower photograph and curve are from area 89 and the upper ones from area 86 from a paraffin section (Woelcke staining).

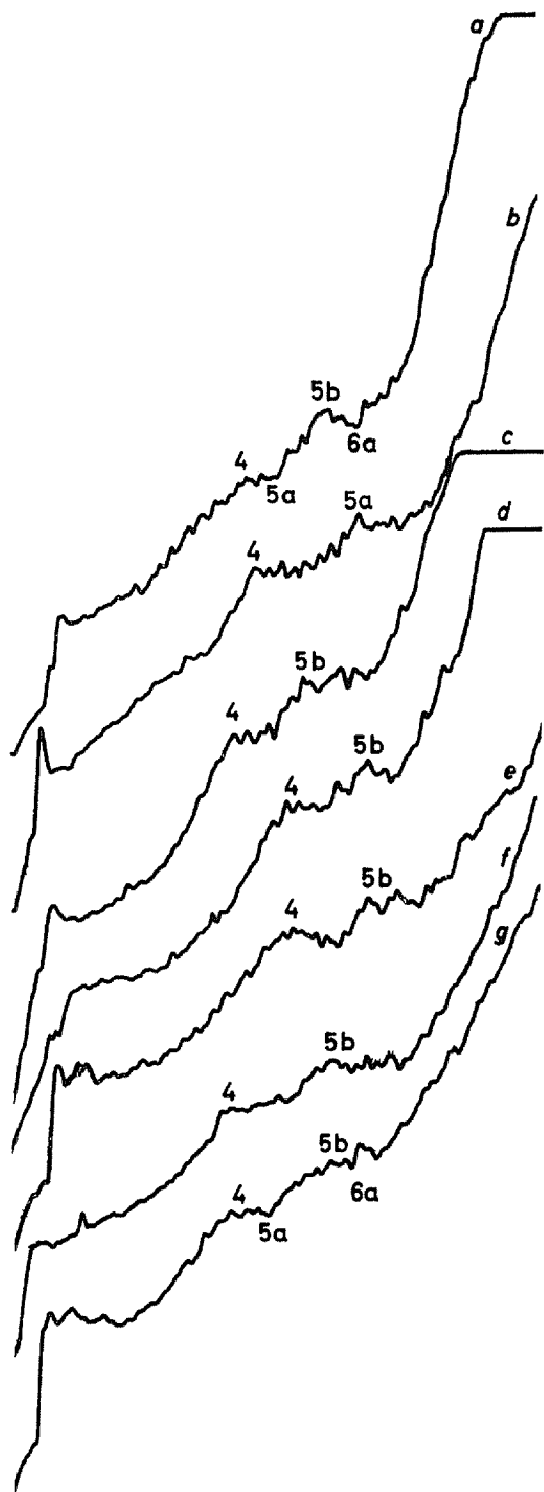


Fig. 9. Extinction curves from the middle third of the inferior parietal lobule (area 89), from 7 sections of 5 hemispheres, 20 \times . a) A 39 l¹, b) A 39 r², c) A 37 r, d) A 37 r, e) A 38 l, f) A 38 l, g) A 37 l.

¹) Brain A 39, left hemisphere.

²) r = right hemisphere.

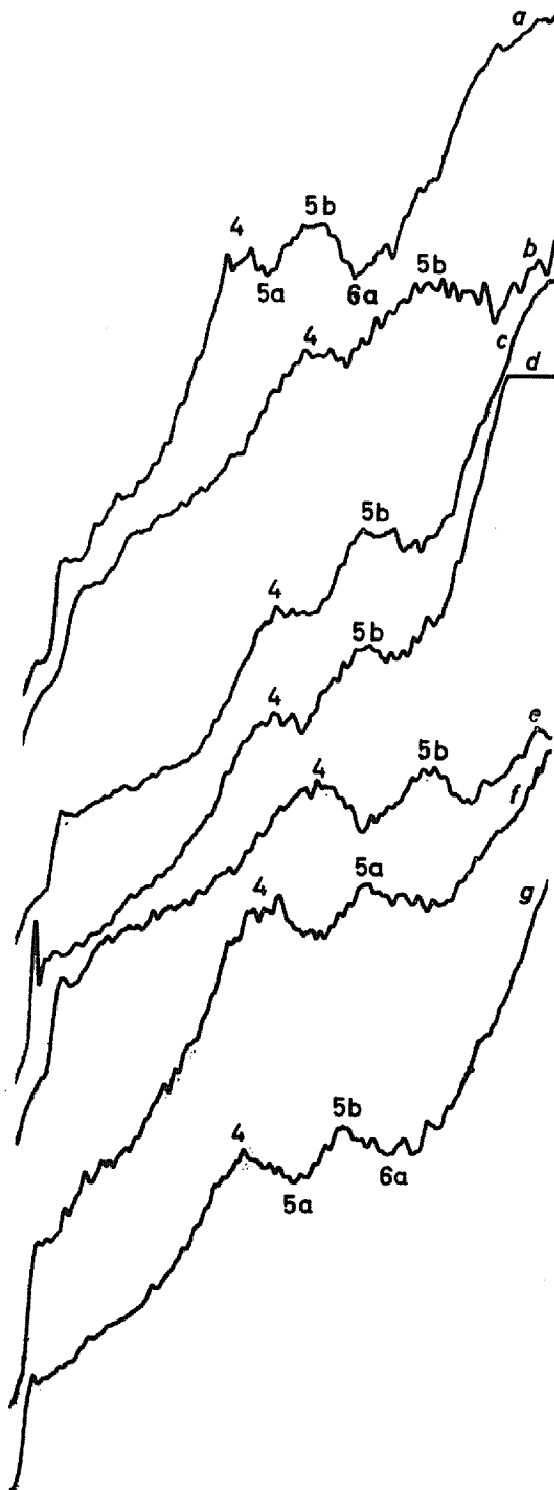


Fig. 10. Extinction curves from area 86 of the intermediate parietal subregion, same frontal planes, and same hemispheres as in fig. 9, 20 \times .

Paraffin sections do not stain quite so deeply with hematoxylin but nevertheless, the different behaviour of the two horizontal stripes of Baillarger is easily recognizable. Figure 12 may show that the differences between superior and inferior parietal lobule in their middle part are easily recognizable in myelin sections by macroscopic observation.

The differences in the posterior part of the parietal lobe are still obvious but somewhat less pronounced. In the inferior parietal lobule we find area 90 which is mainly propeastriate and partially propeunistriate, especially in its posterior subareas. Propeunistriate means that the outer horizontal stripe is slightly more obvious than in a propea-

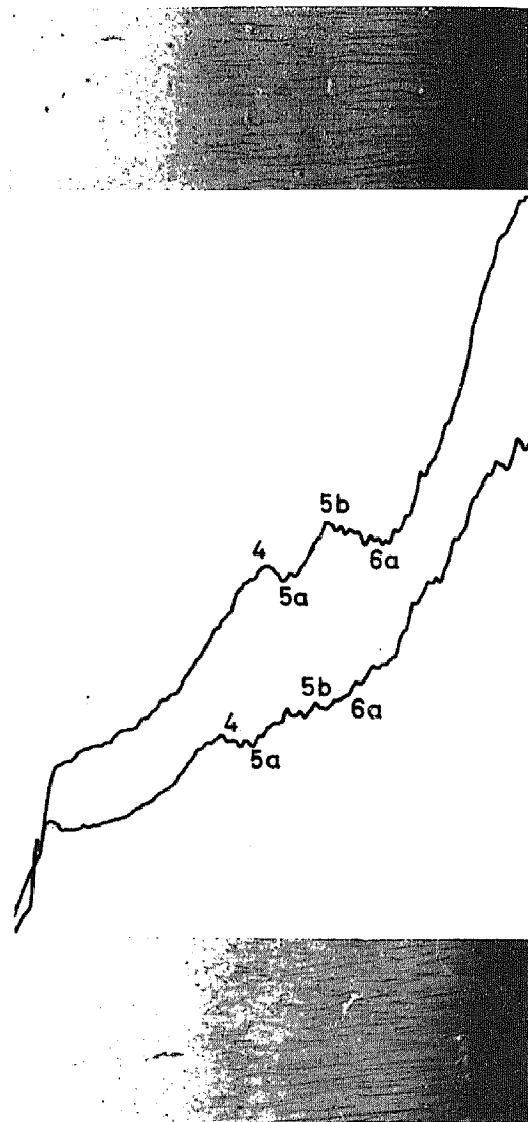


Fig. 11. Photomicrographs and curves from the propeastriate area 89 (base) and the bistriate area 86 (top) from a paraffin section, 20 \times .

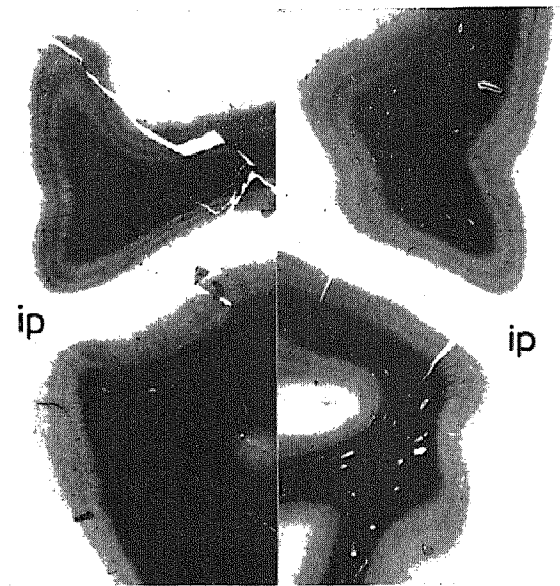


Fig. 12. a) A 39 l, b) A 37 r, 2 \times . Above the intraparietal sulcus (ip) the dark bistriate area 86, below the sulcus the propeastriate area 89.

striate type, because 5a is somewhat lighter than 4. Figure 13a shows subarea 90m from the inferior parietal subregion, and 13b shows area 85 from the subregion parietalis superior-medialis on the same frontal plane. 85 is bistriate as is area 83, with a more anterior position. The area of the superior parietal lobule (85) is again darker than the area of the inferior parietal lobule (90).

The constancy of these findings is shown in figure 14.

Three small parietal subregions have been described by BATSCH in the posterior part of the cingular gyrus (fig. 1b).

The subregion parietalis paracingularis oralis is propeunistriate (fig. 15). The outer horizontal stripe of Baillarger is underdeveloped. Therefore, only a flat elevation is seen in the curve. Then the curve descends a little in 5a. The second elevation of the curve is caused by the inner horizontal stripe. There is only some indication of a descent of the curve in 6a.

In contrast to the poor development of the outer stripe of Baillarger in the anterior fields of the oral paracingular subregion, we find a very pronounced outer horizontal stripe in the posterior field (76) of the caudal paracingular subregion (fig. 16). The areas between these fields show a corresponding behaviour in this respect (fig. 17), following the rule of "gradation" in the sense of VOGT. The areas of the caudal paracingular region

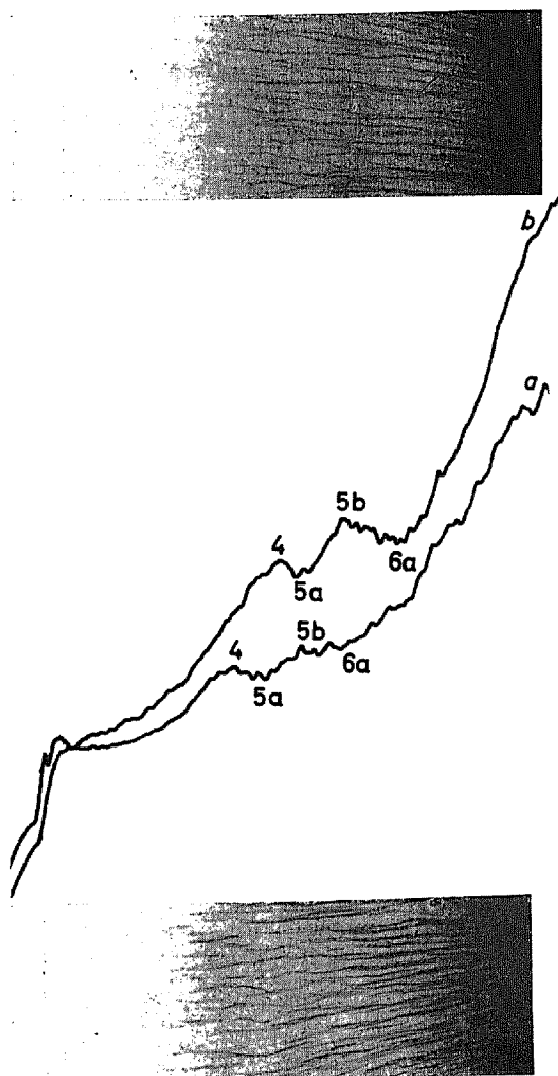


Fig. 13. Photomicrographs and extinction curves, 20 \times . a) Area 90 (subarea 90 m) from the inferior parietal lobule, propeunistriate and relatively poor in myelinated fibres. b) Area 85, from the superior parietal lobule, bistriate, richer in myelinated fibres. Both curves start at the same zero point.

are unistriate, that means that a clear demarcation of the inner horizontal stripe against the deeper layers is missing (fig. 16 and 17).

The areas of the subregio parietalis cingularis show other characteristics. They are either bistriate or conjunctostriate (fig. 18 and 19). Area 91 is the caudal field of this region in the immediate neighbourhood of the allocortex (fig. 1b). Field 91 is bistriate (fig. 18). The curve descends in 5a as well as in 6a so that the horizontal stripes in 4 and 5b are well demarcated. Frontally, adjoining area 92 (fig. 19) is nearly conjunctostriate. The outer and inner stripes of Baillarger are more or less united. A lightening in the photograph and a

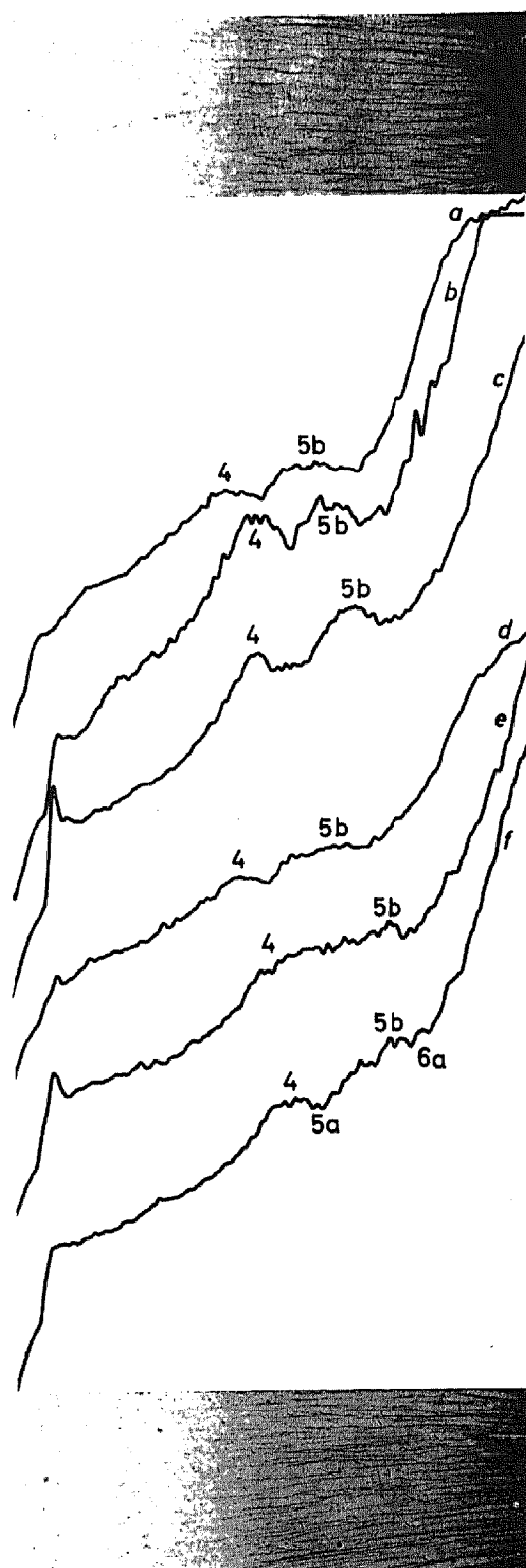


Fig. 14. Extinction curves, 20 \times , a—c from the posterior part of the superior parietal lobule (area 85), d—f from the posterior part of the inferior parietal lobule (area 90), a—c are bistriate, d—f propeastriate.

The elevations of the bistriate type are relatively flat in a, because the curve is from a less deeply stained paraffin section.

a, d = A 61 l, b, e = A 20 r, c, f = A 27 l.

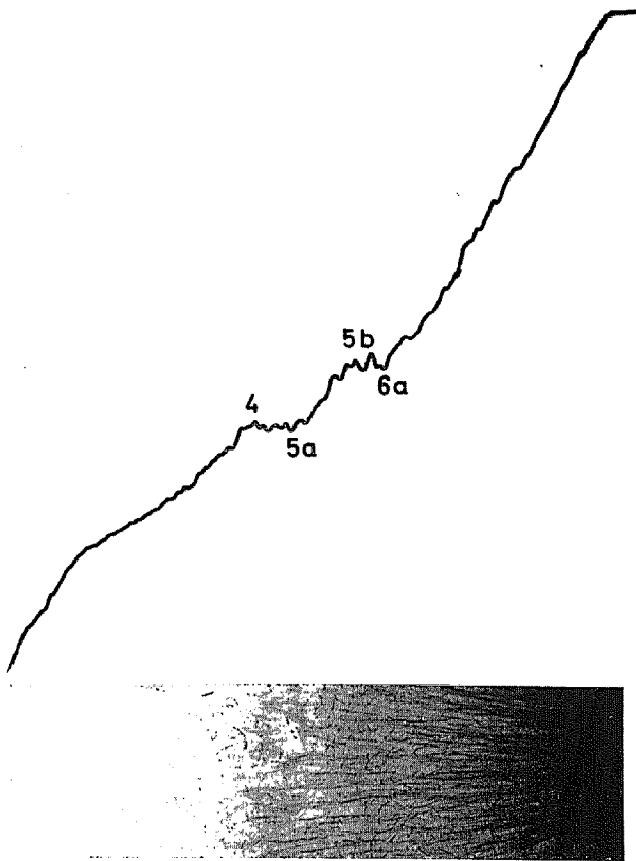


Fig. 15. Photomicrograph and extinction curve from the propeunistriate area 79 of the oral parietal paracingular subregion, 20 \times . Poorly developed outer horizontal stripe of Baillarger in layer 4.

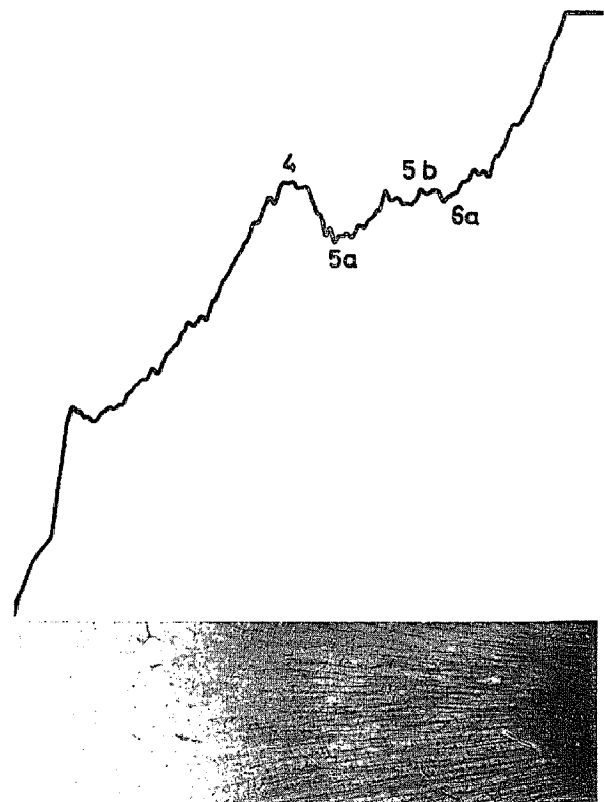


Fig. 16. Photomicrograph and extinction curve from the unistriate area 76 of the caudal parietal paracingular subregion, 20 \times . Prominent horizontal stripe in layer 4.

corresponding descent of the curve is only obvious in 6a.

The parietal cingular region is furthermore characterized by its long radial fibres. This fact, of course, cannot be detected by extinction curves. But by microscopic observation one can follow these radial fibres sometimes up to the sub-layer 3¹.

This is called a propesupraradiate character. The areas of the neighbouring allocortex are supraradiate.

Discussion

The myeloarchitecture of the upper parietal lobule is so different from that of the lower parietal lobule that the two lobules can easily be distinguished from each other by macroscopic observation of myelin sections (fig. 12), as well as by microscopic observation (figs. 3–8, 11–14). The main myeloarchitectonic characteristics, namely the behaviour of the two horizontal stripes of Baillarger

and the general contents of myelinated fibres can objectively be registered with the extinction method. It was proved that the differences between the upper and lower parietal lobule are constant and verifiable (figs. 3–7, 9–14). All the areas of the upper parietal lobule are bistriate, with the exception of the conjunctostriate area 87, whilst the areas of the lower parietal lobule are propeastriate, with the exception of posteriorly situated propeunistriate subareas. The areas dorsal to the intraparietal sulcus have a higher myelin content than the areas ventral to this sulcus. The myeloarchitecture of the same areas of various brains, examined in this study, proved to be rather similar in respect to these main myeloarchitectonic characteristics. Of course, minor variations were found (fig. 9 and 10).

The question arises whether it has been necessary to examine the myeloarchitecture by such a method. If the architectonic differences described here were obvious to all students such a study would perhaps not have been necessary.

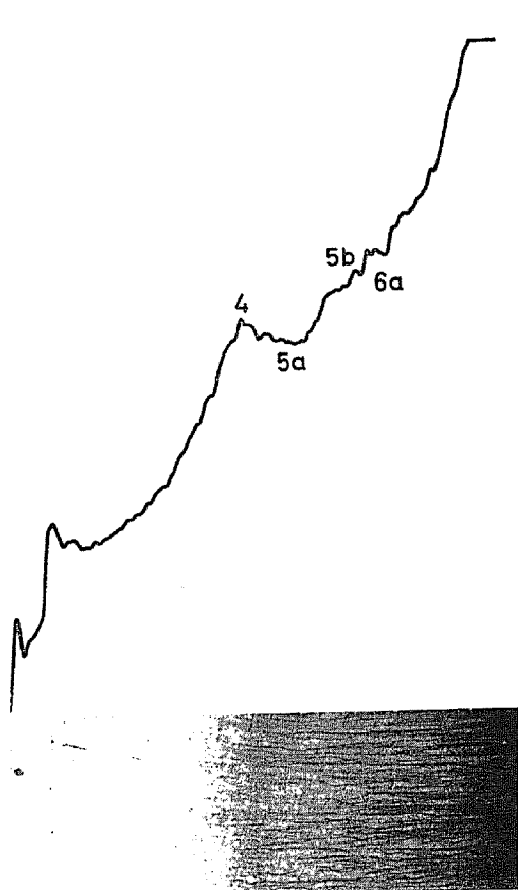


Fig. 17. Photomicrograph and extinction curve from the unistriate area 81 of the caudal parietal paracingular subregion, 20 \times .

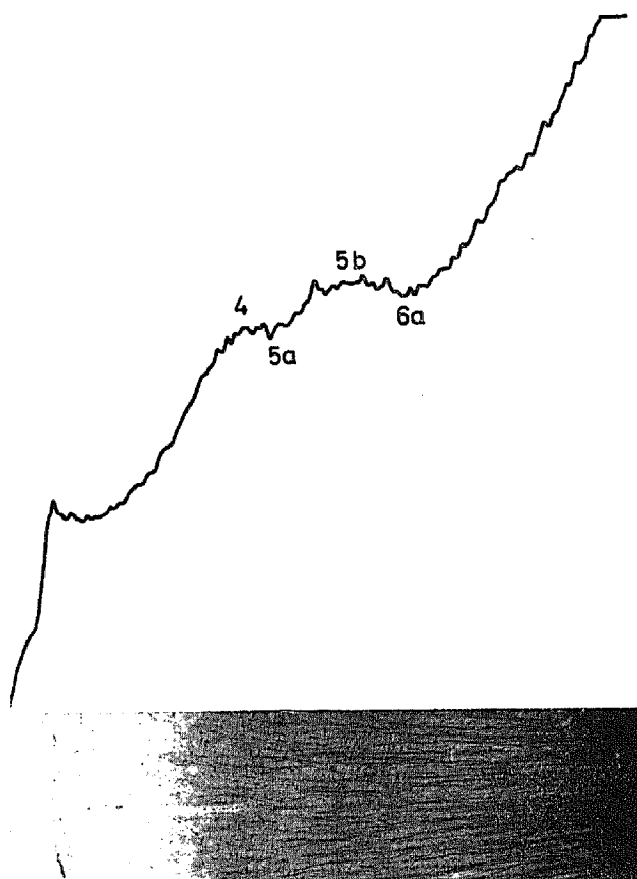


Fig. 19. Photomicrograph and extinction curve from the nearly conjunctostriate area 92 of the parietal cingular subregion.

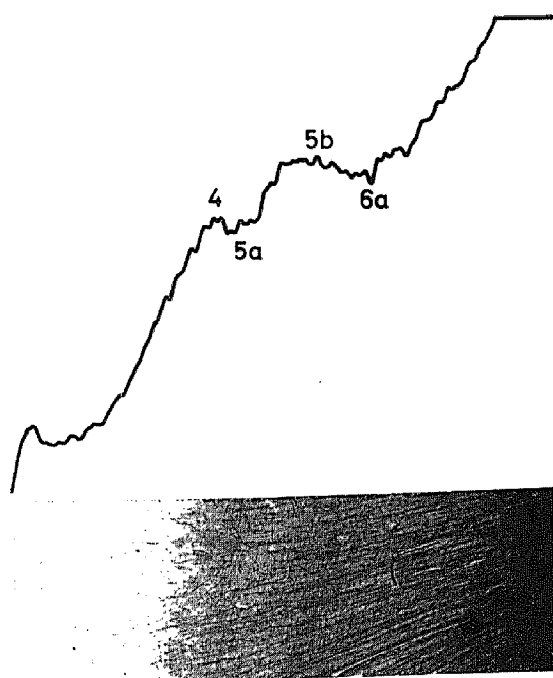


Fig. 18. Photomicrograph and extinction curve from the bistriate area 91 of the parietal cingular subregion, 20 \times .

BAILEY and V. BONIN (1951), after having studied the cytoarchitectonic descriptions of the various authors and comparing them with their own results, wrote, "The laborious studies of the parietal cortex seem to us to result in very little which is verifiable and constant. The structure of most of this cortex is practically identical, and practically identical also with that of the eulaminate frontal cortex." As to the distinction of the upper and lower parietal lobule they said, "We should like to add that the intraparietal sulcus is a big help!"

Their opinion of myeloarchitecture is, "Myeloarchitectonic studies are less reliable".

The result of our study seems to be that the main myeloarchitectonic features are constant and a good help for those who are unable to distinguish the areas of the upper parietal lobule from those of the lower parietal lobule by means of cytoarchitectonics.

As in the studies of the frontal and temporal regions a change of the myeloarchitectonic fea-

tures in steps was found, first described by Vogt as "gradation".

In qualitative myeloarchitectonic studies one always describes the two horizontal stripes of Baillarger and which of them is the denser one. If the outer is denser one speaks of "externodensior". If both stripes have the same density it is called "aequodensius", and the type with a denser inner horizontal stripe is called "internodensior".

In the extinction curves nearly all the areas are "internodensior". This discrepancy between the results of subjective observation and photometric registration may be explained mainly by two facts. The first is that the extinction method does not help to distinguish between horizontal and radial fibres, as the total myelin content of the layers is registered. The radial fibres decrease in number in the upper layers, therefore, they are more numerous in 5b than in 4, contributing to a false internodensior type. The second fact is that our eye, or optic system respectively, is unable to give us reliable information of the absolute light intensity. The outer stripe of Baillarger has lighter surroundings than the inner stripe. Therefore, the outer stripe seems to us to be darker in the case of both stripes, although in reality being of the same density.

Area 76 was the one exception where an externodensior type was found in the extinction curve too (fig. 16). On the posterior (parietal) part of the cingular gyrus the density of the outer stripe of Baillarger decreases in stages (figs. 17 and 15).

When comparing the extinction curves with the microscopic picture one gets the impression that the different extinction of the same layers in areas of the same type, e.g. the bistrirate type, is mainly caused by the different calibres of the myelinated fibres. The number of myelinated fibres per unit volume seems to be of less importance, at least in this special case. However, the number or the total length of myelinated fibres is a contributing factor in establishing the different myeloarchitectonic types (bistrirate or unistrirate for instance). But these relationships can only be revealed by refined quantitative methods, as those used by HAUG (1968).

No constant relationship between cell density and myelin content was found.

However, a comparison with the myelogenetic maps is of great interest. The areas with the highest myelin content are the first to start with the process of myelinization. The highest myelin content was found in the intermediate parietal

subregion which seems to correspond with Flechsig's intermediate area 17. The lowest myelin content was seen in areas 89 and 90 of the inferior parietal lobule, which agrees rather well with Flechsig's terminal areas 37 and 49.

The myelogenetic map of a nineteen-day-old child (after C. and O. Vogt 1904) closely corresponds with the myelin content of the cortex of the adult as demonstrated by the extinction curves.

Summary

The myeloarchitecture of the human parietal region has been studied in 8 hemispheres with an extinction method. The myeloarchitectonic features most valuable for a differentiation of the cortical areas are the behaviour of the two horizontal stripes of Baillarger and the general content of the areas in myelinated fibres. These two features can be registered reliably by extinction curves. Absolute values cannot be determined since myelin stains are no quantitative methods in a strict sense. But the relative values are sufficient for a characterization and differentiation of the areas.

All the areas of the subregion parietalis superior-medialis are characterized by two distinct horizontal stripes of Baillarger (bistrirate type) and a higher fibre content than found in the inferior parietal subregion. The highest fibre content was found in the subregion parietalis intermedia. In one of the two areas of this subregion the two horizontal stripes are united to form a broad band (conjunctostriate type). The horizontal striping is blurred in the areas, poor in fibre, of the inferior parietal subregion (propeastriate type).

Various types (bistrirate, propeunistrirate, unistrirate and nearly conjunctostriate) were found in the three small parietal subregions on the posterior part of the cingular gyrus.

Only minor variations were observed in the 8 hemispheres studied. Therefore, the main myeloarchitectonic features seem to be constant enough to be used for a quick and reliable orientation within the cerebral cortex.

Zusammenfassung

Die Myeloarchitektonik der Regio parietalis wurde an 8 menschlichen Hemisphären mit einer Extinktionsmethode studiert. Die für eine Unterscheidung der Rindenfelder wichtigsten Merkmale sind das Verhalten der beiden Horizontalstreifen von Baillarger und der allgemeine Markscheidengehalt. Diese beiden Merkmale können zuverlässig mittels Extinktionskurven registriert werden. Absolute Werte können nicht bestimmt werden, weil Markscheidenfärbungen keine echten quantitativen Methoden darstellen. Die relativen Werte reichen jedoch für eine Charakterisierung und Unterscheidung der Rindenfelder aus.

Alle Areae der Subregion parietalis superior-medialis sind durch zwei deutlich hervortretende Baillarger'sche

Streifen (bistriärer Typ) und durch einen im Vergleich zum unteren Parietalläppchen höheren Markfasergehalt gekennzeichnet. Der höchste Markscheidengehalt wurde in der Subregio parietalis intermedia gefunden. In einer der beiden Areae dieser Subregion sind die beiden Bailarger'schen Streifen zu einem breiten Band vereinigt (conjunctostriärer Typ).

Die Horizontalstreifung ist verwaschen in den markfaserarmen Feldern der Subregio parietalis inferior (propeastriärer Typ).

Verschiedene Typen (bistriär, propeunistriär, unistriär, und propeconjunctostriär) wurden in den drei kleinen parietalen Subregionen im hinteren Anteil des Gyrus cinguli gefunden. Zwischen den 8 untersuchten Hemisphären bestanden nur geringe Unterschiede in der Myeloarchitektonik. Die myeloarchitektonischen Hauptmerkmale erwiesen sich somit als ausreichend konstant und können daher für eine rasche und zuverlässige Orientierung in der Großhirnrinde verwertet werden.

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