

*Citation:*

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condition of the so-called "Eiweissalze" then depends on the properties of the anion or the cation <sup>1)</sup>.

In a later publication, however, he communicates that the opposed charges of cations and anions do not come into play here <sup>2)</sup>; he does believe though in a relationship between the action and the valency of the cation, viz. that the antitoxic effect increases with the valency of the cation <sup>3)</sup>.

As regards uranium there is, however, no ground for attributing its effect to the valency of the cation, for, then there must be a quantitative difference in the doses of the bivalent uranylion and the quadrivalent urano-ion, which difference was not revealed in my experiments. Consequently if neither the charge nor the valency play any part here, the only conclusion to be drawn is that the uranium-atom must be present in the ion.

This atom then has a property that determines its action in RINGER's mixture. This action is antagonistic and stimulating.

A special investigation also taught me that the other elements of this group of the periodical system do not act likewise. I hope soon to be able to point out a new element possessing the peculiar property of potassium, rubidium and uranium, discussed in this paper.

**Anatomy.** — "*The relation of the plis de passage of GRATIOLLET to the ape fissure*". By Dr. D. J. HULSHOFF POL. (Communicated by Prof. C. WINKLER).

(Communicated in the meeting of April 28, 1916).

In a previous publication <sup>4)</sup> which I wrote, I came amongst other things to the conclusion, that the apenfissure is an inconstant furrow, and that, in case it should be formed, it only takes place after the other principal fissures have reached total development. Moreover I explained, that not only in the different monkey species the fissura simialis can be formed in different places, but also that in the same species, the spot, within certain limits, can change.

For instance one finds in semnopithecii and macaci the  $m + m'$  sulcus (s. par. occ. lat.) at one time on the frontal face of the ape fissure, at another time on the back of it, what naturally

<sup>1)</sup> Bioch. Zeitschr. Bd. 36, 1911 S. 279.

<sup>2)</sup> Journal of Biol. Chem. Vol. XIX, p. 431

<sup>3)</sup> PFLÜGER's Archiv. Bd. 88, S. 68.

<sup>4)</sup> HULSHOFF POL. D. J. The fissura simialis in embryos of Semnopithecii. These Proc. XVIII, p. 1571.

proves, that not always the same part of the brainsurface is pushed downwards.

I also found out, that the ape fissure is formed when at a certain foetal period the occipital part of the brain begins to develop stronger than the preceding part, and consequently the latter is pushed downwards.

According to the centre of overgrowth (greater growth) lying more proximally or more distally, also the line of curvation, where the operculisation is going to appear (ape fissure), will be placed more to the front or more to the back.

It is also possible that the centre of overgrowth is placed more medially or either laterally.

This difference in localisation which influences the place of the curvature where the apefissure will be formed, will be of importance for the origin of the plis de passage.

As I pointed out the larger growth of the occipital lobe, compared to the preceding part, being the cause of origin of the fissura simialis, of course the possibility is not excluded, that also other instances help to form that sulcus.

The more these instances co-operate, the more complicated the process will be and the more intricate the aspect of the plis de passage is going to be.

To well comprehend this, it is desirable to bring to mind in a few words, what has been written about the plis de passage.

As far as I know, GRATIOLET<sup>1)</sup> has been the first that has treated the subject in particulars.

Citing ZUCKERKANDL<sup>2)</sup>, GRATIOLET makes a difference between four outer and two inner plis de passage.

The first and second outer or lateral pli de passage lie in the fissura parieto-occipitalis and connect the lobus parietalis with the occipital part. The third and fourth outer or lateral plis de passage lie *superficially* and should connect the second temporal convolution with the occipital lobe.

This view of GRATIOLET dates from 1854 and therefore it is desirable, in order to prevent confusion, to add a few alterations, without changing however his meaning.

For instance neither GRATIOLET, nor FLATAU and JACOBSON<sup>3)</sup>

<sup>1)</sup> GRATIOLET. Memoires sur les plis cérébrales de l'homme et des Primates. Paris 1854.

<sup>2)</sup> ZUCKERKANDL, E. Zur Morphologie des Affengehirnes. Zeitschr. f. Morph. u. Anthr 1903.

<sup>3)</sup> FLATAU C. u. JACOBSON L. Handbuch der Anatomie des Centr. Nervensyst. der Säugeth. Berlin 1899.

made a difference between the fissura parieto-occipitalis lat., and the ape-fissure. According to them, these sulci are to be considered as one.

The researches of KUKENTHAL and ZIEHEN<sup>1)</sup>, KOHLBRUGGE<sup>2)</sup>, ZUCKERKANDL<sup>3)</sup> and myself<sup>4)</sup> however have pointed out, that a sharp distinction between those two sulci has to be made.

Although the sulcus parieto-occipitalis lateralis ( $m + m'$  KUKENTHAL and ZIEHEN) in cynopithecini will nearly always be found in the ape fissure (K.), yet it may not be identified with it.

In the interpretation of GRATIOLET therefore this change has to be made, that the first two plis de passage do not lie in the fiss. par. occ. lat. but in the fissura simialis.

His view about the 3<sup>rd</sup> and 4<sup>th</sup> pli de passage can remain unchanged.

As to the two inner or medial plis de passage, the upper should be lying in the fossa par. occ. medialis, while the lower remains on the surface.

The upper originates from the top of the praecuneus, then runs downwards, afterwards climbs to the top of cuneus, where it is united to the 1<sup>st</sup> lateral pli de passage.

The lower unites the lower part of the cuneus with the base of the praecuneus and it forms partially the upper ridge of the fissura calcarina. This convolution is called at present the gyrus cunei of ECKER.

It is comprehensible that after GRATIOLET the plis de passages have often been the subject of study.

As however the sulci in general, and those of the occipital part in particular show a number of varieties, as moreover the material, which was examined, gradually took greater dimensions, then it is not strange that the conceptions about the plis de passage altered.

It would take me too long to go into particulars with respect to the opinions and contradictions met with, and therefore it will suffice to communicate only the most interesting items of them.

BISCHOFF is of opinion that between the first outer (parietal) and upper (medial) pli de passage, there does not exist a difference. If the first is drawn into the depth, then it continues into the second. If it lies on the surface then the second does not exist in reality.

1) KUKENTHAL, W. u ZIEHEN TH. Untersuchungen über die Grosshirnfurchen der Primaten, Jenaische Zeitschr. Bd 27, 1895.

2) KOHLBRUGGE, J. H. F. Die Variationen an den Grosshirnfurchen der Affen mit besonderer Berücksichtigung der Affenspalte. Zeitsch. f. Morph. u. Anthr. 1903.

3) Note 2 p. 105.

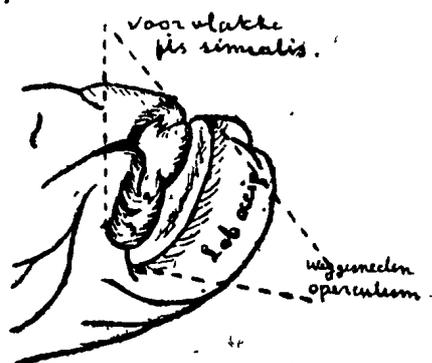
4) l. c.

BISCHOFF also thinks that there are monkeys in which the first pli de passage is not present. FLATEAU and JACOBSON join in principle his view.

This opinion was attacked by others and in particular it was ZUCKERKANDL<sup>1)</sup>, who gave his fullest attention to the plis de passage.

Not only does he point out, pg. 286, how the 3<sup>rd</sup> outer pli de passage, which according to GRATIOLET should be lying on the surface, can also be found in the depth of the ape-fissure, but he also describes to us a three-rayed figure, which should develop by the union of the 1<sup>st</sup> and 2<sup>nd</sup> lateral plis de passage and he plans a hypothesis about the way of origin of the 1<sup>st</sup> lateral pli de passage out of the 2<sup>nd</sup>.

As to the presence of the 3<sup>rd</sup> lateral pli de passage in the ape-fissure, instead of on the surface of the hemisphere, he points out, that this is only possible, when the ape-fissure prolongs in caudal direction and is united with the s. occipitalis (b).



voorvlakte = frontal face  
weggesneden = resected  
Fig. 1.

The three-rayed form of these plis de passages one finds reproduced most clearly on his fig. 2, of which a reproduction is given (fig. 1). The names in it are added to it by me, the figures by ZUCKERKANDL. He points out, that the first pli de passage (1) is curved and the same is also the case with the second pli de passage (2). In the first the top of the pli is directed medially in the second laterally. These two plis de passage continue caudally in one, forming in this way a three-rayed figure.

As to the origin of the first pli de passage, ZUCKERKANDL demonstrates in first instance on page 293, that the first pli de passage can be composed by two pieces; in other words it is a body, which only afterwards develops into one and therefore the union of the parietal and occipital part of the brainsurface is not primarily, but secondarily on that spot.

On page 296 his view is worked out further. The second pli de passage of GRATIOLET should form the real primary union and should run in oblique direction from the gyrus angularis towards the top of the operculum parietale.

<sup>1)</sup> ZUCKERKANDL E., "Zur Morphologie des Affengehirnes" Zeitschr. f. Morph. u. Anthr. 1903.

In the further development there should originate out of this part lying at the back, out of its upper portion, an outgrowth, directed frontalwards, which grows towards the back ridge of the upper parietal-convolution. This frontalwärts growing piece will come in contact with a part of the upper parietal convolution, which is growing backwards, therefore towards the occipital pole. When a union is accomplished by these two parts which are growing towards each other and which belong respectively to the lobus parietalis and occipitalis, then the 1<sup>st</sup> pli de passage is formed.

As the above said shows the way in which ZUCKERKANDL thinks the origin of the 1<sup>st</sup> pli de passage to be, yet on the other hand he joins the other investigators, who are of opinion that the 1<sup>st</sup> and 2<sup>nd</sup> lateral pli de passage are lying primarily in the depth and only secondarily come to the surface. Thus he writes on page 289, on which he divides the 1<sup>st</sup> pli de passage into three forms: "Bei der dritten Form ist die I Uebergangswindung wie bei den Anthropoiden an die Oberfläche der convexen Hemisphärenfläche getreten".

From this it is distinctly proved that he assumes that these plis de passage ought to be lying in the depth, but in a few cases can come to the surface.

It is to the merit of KOHLBRUGGE, who first distinctly announced the probability, that the conception prevailing up to the present day was wrong.

On p. 242 he writes: "Ich nehme an, dass die Uebergangswindung bei allen Affenembryonen erst oberflächlich liegt, etwa wie die Insula Reilii (bei Embryonen) und erst später durch Entwicklung der angrenzenden Teile in die Tiefe versenkt wird".

His communication did not receive the attention which it deserved.

The cause of this has to be looked for in different directions.

In first instance, the view of the plis de passage which primarily are lying on the surface, is totally in contradiction with what was accepted till now. The hypothesis of ZUCKERKANDL, which I previously described in short, and which appeared in the same year as the communication of KOHLBRUGGE, points to it.

As the latter moreover only possessed full-termed material, he could not deliver the *evidence* to his conception.

These two facts in themselves made already improbable that much attention should be drawn to his communication.

Add to it moreover, that he does not always consistently work out his view, as he e.g. writes on page 220: "CUNNINGHAM hat die

Uebergangswindung sogar bei *Cebus* hervortreten sehen. Ich konnte gleiches bei einem *Papio porcarius* constatieren".

From this one may conclude that KOHLBRUGGE too has seen a convolution "hervortreten" and this naturally was not his intention to write.

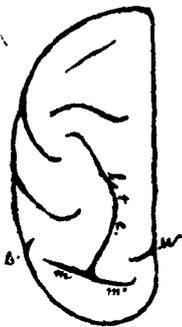
His comparison too, of the ape-fissure with the insula Reilii was not a lucky one. We know to be sure (EDINGER p. 47) that the latter is that part of the developing pallium, which is placed on the corpus striatum. By the strong union between these two, it remains backwards in growth and causes in this manner the sinking down of it. As however such a relation does not exist on the lateral surface of the occipital brain, his example of comparison was not happily chosen.

Notwithstanding all this, it is to the credit of KOHLBRUGGE that he has come to the conclusion (without the service of embryonal material), that the plis de passage primarily ought to have been on the brainsurface.

I already wrote that the view of KOHLBRUGGE was left unnoticed by the investigators, which e.g. is most strongly proved by a communication of v. VALKENBURG<sup>1)</sup> published much later, where he writes on page 1042 "because part of the transition-convolutions (the first) has become superficial" ... Further on "If now moreover the 2<sup>nd</sup> and 3<sup>rd</sup> transition convolution's become superficial i. e. if they pass from the bottom of the monkey-slit to the surface of the lob. parietalis" ...

By these views of v. VALKENBURG it is most convincingly proved, that the general opinion is still that the plis de passage are lying primarily in the depth and only secondarily come to the surface.

Turning to the embryonal material, which I gathered and often referring to my previous communication concerning the origin of the convolutions at the place where the ape-fissure is going to be formed, we see there that up to an embryo of 172 grams, there is no question of an apofissure, but that all the important sulci on the brain surface have already been formed (fig. 2).



(Fig. 2).

l + e = s. inter parietalis.  
 m + m' = s. parieto. occipit. lat.  
 w = incisura sulc. par. occ. med.  
 b = s. occip. temp. later. seu  
 , occip. inf.

<sup>1)</sup> VAN VALKENBURG, C. T., On the occurrence of a monkey-slit in man". Royal Academy of Science. Amsterdam 1913.

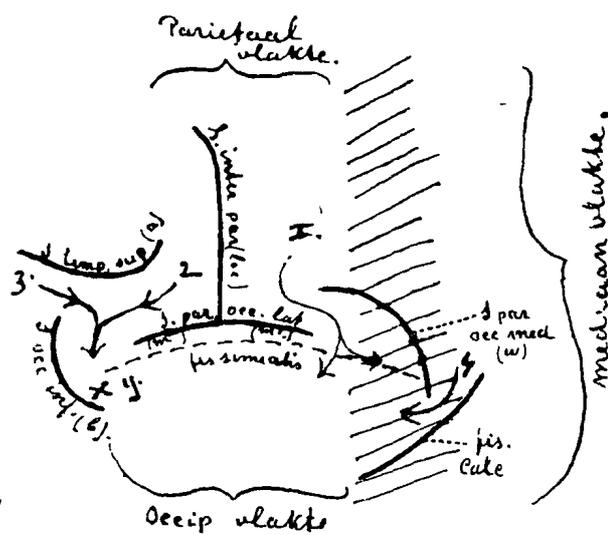
Now we know that the lobi parietalis and occipitalis are separated, on the surface of the hemisphere by the s. par. occ. lat. ( $m + m'$ ) and on the medial surface by the s. par. occ. med. ( $w$ ), while the lateral border is formed by the s. occip. inf. ( $b$ ).

Before the formation of the apessure there are between these sulci bridging convolutions which pass from the one lobus to the other.

The first communication comes from the arcus parieto-occipitalis along the medial end of the  $m'$  and continues in this way on the occipital surface (on fig. 2 this communication first goes between  $l + e$  and  $w$ , and later medially from  $m'$ . On fig. 3 it is indicated by the arrow sub I. One sees it deviating occipitalwards to the lateral and medial surface).

The second communication comes from the gyrus angularis (fig. 3 sub 2) and from the gyrus temporalis II (fig. 3 sub 3), to pass as a single convolution between the sulcus occ. inf. and the lateral part of the sulc. par. occ. lat. ( $m$ ), towards the lobus occipitalis.

The third communication is found on the medial surface, beneath the sulcus par. occ. medialis. It is the gyrus cuneus of ECKER, which



vlakte = surface

Fig. 3.

here connects the praecuneus with the cuneus. The arrow sub 1 indicates on fig. 3 the direction of the communication.

In *semnopithec*i one therefore finds three *bridging convolutions* lying on the surface, between the parietal and temporal part on the one side and the lobus occipitalis on the other side. *These three communications are the plis de passage.*

In my former publication I made clear, that when in *semnopithecus* the ape-fissure is being formed, (result of the overgrowth of the occipital part), the line of curvature begins either caudal or nasal of the  $m + m'$ . In the schematic drawing (fig. 3), I granted, that this line of curvature (see dotted line) is lying caudal of the  $m + m'$ , and therefore when the ape-fissure is later being formed, the three  $l + e$ ,  $m + m'$  and  $w$  have to be found on the frontal face of it.

As the ape-fissure generally extends from a point on the lateral surface, mostly medially from  $b$ , (s. occ. inf.) and from there over the ridge of the mantle towards the medial face and there is united with the ventral part of  $w$  (s. par. occ. med.), the following will happen with the three plis de passage (see dotted line fig. 3).

The "lateral" on fig. 3 indicated by the arrows 2 and 3, will disappear for a part e.g.  $y$  in the ape-fissure. The part  $x$  however will remain on the surface. Only in case the ape-fissure is extended unto the  $b$  sulcus, then too the part  $x$  will disappear in the depth. Such a case ZUCKERKANDL describes on page 286 in *cynocephalus marmon* and *cercopithecus patas*.

The "intermedial" communication, indicated on fig. 3 by the arrow 1 will disappear partly or wholly in the depth.

The "medial" pli de passage, indicated on fig. 3 by the arrow 4 will never disappear in the depth, because till now, as to my knowledge, no ape-fissures have been described, which pass on to the fissura calcarina.

The above mentioned, which is a logical result of what the development of the ape-fissure teaches us, is not in accordance with the conception of GRATIOLET and others, that the number of the plis de passage should be six and of these 4 on the lateral and 2 on the medial face.

The cause of the difference of opinion has to be looked for in the starting-point of the investigation.

I from my point of view, believe that in this case should prevail what embryology teaches us, while GRATIOLET started from that which he found in adult specimens.

Now it is comprehensible that when an ape-fissure is going to be formed and during this process the fore part is pushed downwards, this cannot always happen equally regularly. Therefore it is natural, that after opening the ape-fissure not always the same aspect will be shown to us. During the downwards pushing there will be formed curves, plis and sulci, which will not always obtain the same form. The sooner this will not be the case where the influence

is not always felt in the same way. E.g. I already pointed out that the centre of overgrowth can be lying more to the front or more to the back, and also more medially or more laterally. Moreover there will be still other influences, unknown to us. Result of this is that although in general the same aspect may be rather regularly found, yet this is not the case with the subdivisions.

Accepting this, the drawing, which shows the depth of the ape-fissure after resecting of the operculum, can differ within certain limits.

Now, when one exclusively derives from what the ape-fissure in adult animals shows, then one will be inclined as it were to value highly those curves and sulci, which are only secondarily formed.

If we on the other hand keep to the aspect that embrology shows to us, then the process becomes much simpler and more comprehensible.

If we keep to the latter, which seems rational to me, then one can speak in *Semnopithec*i and from analogy in all related monkeys, only of the three plis de passages as I described them.

Now the six plis de passages, described by GRATIOLET are derived from the three which I described and therefore they have many mutual characters.

Thus GRATIOLET describes three plis de passage between the *b*-sulcus (s. occ. inf.) and the lateral part of *m* (s. par. occ. lat.). See fig. 3, the arrows 2 and 3. In reality one only knows my "lateral" pli de passage, of which a larger or smaller part is pushed into the ape-fissure.

The 2<sup>nd</sup> + 3<sup>rd</sup> + 4<sup>th</sup> plis de passage of GRATIOLET agree with the "lateral" pli de passage as I described it.

GRATIOLET moreover knows a first-outer and an upper-inner pli de passage, which at a point run into one.

From the figures 2, and 3 sub I it is to be seen, that at that point there is but one bridging convolution, which goes along the arcus par. occ. to the back of the brain. If an ape fissure should be formed, then this part in general is pushed for a smaller or larger portion in the depth.

The 1<sup>st</sup> lateral and the upper medial plis de passage of GRATIOLET form therefore together the "intermedial" pli de passage, according to my description.

The lower-median pli de passage of GRATIOLET, the gyrus of ECKER, which forms the communication between cuneus and praecuneus, appears in fig. 3 above the fissure calcarina (sub 4). This medial pli de passage remains also in the new classification

unaltered. As the ape fissure, to my knowledge, never continues until the *fissura calcarina*, this pli de passage always remains on the surface.

As the above-mentioned brings about an important change in our conception concerning the plis de passage it is desirable, that the names keep count with it.

1. In relation to the localisation I therefore propose to call the pli de passage, which lies between the s. occ. inf. (*b*) and the lateral part of *m* (s. par. occ. lat.) on fig. 3, indicated sub 2 and 3: the *gyrus annectens lateralis*. This thus agrees with the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> pli de passage of GRATIOLET.

2. We shall call the communication between lobus parietalis and occipitalis on fig. 3, indicated sub 1: the *gyrus annectens interpositus*. Thus it is found between the lateral and medial one and agrees with those two which were put down as the 1<sup>st</sup> lateral and upper-medial ones of GRATIOLET.

It will be superfluous to call special attention to the fact, that there where this bridging convolution already exists before the ape fissure is formed and commences as a whole, that there the hypothesis of ZUCKERKANDL, which I already in short referred to and according to which it should be formed out of two portions, is wrong.

3. We shall call the communication between cuneus and prae-cuneus (fig. 3 sub 4) the *gyrus annectens medialis*. This agrees therefore with the lower inner pli de passage of GRATIOLET.

The question as to the relation of the plis de passage in other monkeys now arises.

In my former report I pointed out that the place where the ape fissure is being formed, can be totally different in different monkey-species.

Thus it is known that in some of the platyrrhines, e. g. ateles, the sulcus interparietalis (*l + e*) although ending in a T-piece, in the same way therefore as in the semnopithecii, ending in the *m + m'* sulcus (fig. 2), possesses an ape-fissure, which is lying caudally from it. The *m + m'* sulcus is thus not pushed down in the ape fissure. Now if we accept this *m + m'* sulcus (s. par. occ. lat.) to form the border between the lobi parietalis and occipitalis, then follows, that the ape fissure in these monkeys is formed on the occipital face.

If we keep to the conception, that the plis de passage, as it is in semnopithecii, macaci etc., form the communication between subdivisions of the brain, differing from each other (e. g. parietal and occipital, or temporal and occipital) then, in case the ape fissure is

formed *totally on the occipital surface*, naturally there is not one single pli de passage pushed down in the depth. These remain in front of the ape fissure on the surface.

In ateles and related monkeys therefore all the plis de passage are lying on the surface.

But when the fissura sismalis becomes but deep enough, then there will be such important contorsion of the brainsurface which is pushed down, that the conformity with plis de passage, superficially examined, becomes very great. If one however observes the origin of these plis, and curves, then they appear to have been formed out of a former smooth brainsurface. These therefore are not real plis de passage.

Again different is the relation in the anthropoids.

That in the latter it entirely changes, one learns from the report of BOLK<sup>1)</sup> of two gorillabrain.

On his figures 4(a) and 7(b) the sulcus interparietalis ( $l + e$ ) proves to end in the ape fissure. On fig 4 the ape fissure continues over the edge of the brainmantle on the medial surface. On the right hemisphere (p. 205, fig. 18) the ape fissure does not come in connection with the *w* sulcus (par. occ. med.). This happens however on the left brainhalf (p. 220, fig. 24). On fig. 7 again it is different: there the ape fissure on the left side only comes to the edge of the brainmantle, on the right it does not even reach the latter.

As from the above mentioned the incisura parieto-occ. med. proves not once to have penetrated into the depth, it follows without more that the interposed pli de passage (gyr. annectens interpositus mihi, or 1<sup>st</sup> lateral pli de passage of GRATIOLLET) has only disappeared for a small part in the ape fissure.

This agrees on the whole with the researches of others on gorillabrain, which had as result that the interposed pli de passage totally remains on the surface.

Although this last does not quite agree with the researches of BOLK, yet they agree that the ape fissure in anthropoids, as to the medial part, is not by far so well developed as in the semnopithecii.

As to the lateral pli de passage (gyrus annectens lateralis) this remains in gorillas related in the same way as in semnopithecii and macaci. It is found therefore between the *m* and *b* sulcus and a smaller or larger part of it will be pushed down in the depth.

An exception to this is given by the view which BOLK shows us on fig. 8, p 153. By the strong development of the back branch ( $\alpha^3$  of

<sup>1)</sup> BOLK, L. Beitrage zur Affenanatomie. — Das Gehirn von Gorilla. — Zeitschr. f. Morph. u. Anthr. 1909.

KUKENTHAL and ZIEHEN) of the sulcus temporalis superior, the latter has not only pushed down the *b* sulcus, but it too has divided the lateral pli de passage as it were into two portions. In this drawing one could speak of two lateral plis de passage, which therefore run towards the occipital surface. But as this example is an exception, it cannot be counted of much worth. Yet it proves that where in the higher development the complex of sulci becomes more complicated, it can be of influence on the image of the plis de passage. The embryonal material could show us the way in this case.

From what is found in anthropoids follows that the ape-fissure on the whole is less developed than in semnopithecids and related monkeys. It gives the impression as if the sulcus begins to contract.

#### CONCLUSIONS.

1. The plis de passage in foetal life are lying on the surface.
2. They form, lying on the surface, the communication between the lobi parietalis and temporalis with the lobus occipitalis.
3. In semnopithecids, macacids and related monkeys only three plis de passage are known
  - a. gyrus annectens lateralis, lying between the *m* and *b* sulcus.
  - b. gyrus annectens interpositus, lying on the mantle surface, forming the continuation of the arcus parieto-occipitalis.
  - c. gyrus annectens medialis, forming the communication between the cuneus and praecuneus, lying above of the fissura calcarina.
4. When the ape-fissure is formed on the border of the parietal and occipital part (semnopithecus, macacus etc.), then the lateral and interposed-gyrus annect. are pushed totally or partially in the depth.
5. When the ape-fissure is formed on the occipital surface (ateles, nycticebeus tardigradus etc.), then it does not come in contact with the plis de passage and these therefore remain on the surface.
6. In the anthropoids the ape-fissure is considerably less developed than in semnopithecids etc.

**Physiology.** — “Quantitative determination of slight quantities of  $SO_4$ . II. Contribution to macrovolumetrical analysis”<sup>1)</sup>. By Prof. H. J. HAMBURGER.

(Communicated in the meeting of April 28, 1916).

#### 1. Introduction.

Repeatedly physiologists and clinicists find themselves confronted by the task of determining quantitatively very slight quantities of some substance and if no good titration method is available, the

<sup>1)</sup> A more detailed account will be given in “Biochemische Zeitschrift” 1916.