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cranium and the vertebral column a free segmenthalf is found, that has certainly an osteogenetical, perhaps even a hemispondylogenetical potency.

It is now the question whether this potency is activated, and if so, what phenomena are the results of this activation. Though it is not the intention of this communication to give a categorical answer to the question submitted here, I will however indicate already the direction in which, according to my opinion, the answer must be looked for, and fix the attention to the fact that in the cranio-vertebral region a great many phenomena present themselves, the morphological signification of which has as yet not by far been defined in the same way by all investigators. I have here especially an eye to the variations of the atlas in the region of the sulcus arteriae vertebralis, to the different phenomena on which in fact the Pro-atlathypothesis of ALBRECHT is founded, to the concrescencia atlanto-occipitalis and the manifestation of the occipital vertebra.

I think, that all these phenomena can be brought under one point of view, namely the existence of the above mentioned segment-half *I $\alpha$* .

A further investigation into this question will form the subject of a following communication.

**Anatomy.** — “*The genetical signification of some atlas-variations*”.

By Dr. J. A. J. BARGE. (Communicated by Prof. L. BOLK).

In the previous communication, “On the metamerological signification of the cranio-vertebral interval” I have fixed the attention to the fact, verified also by investigation, that between the atlas and the caudal boundary of the cranium, in consequence of the intersegmental position of the craniovertebral interval and of the process of the re-segmentation of the vertebral column, necessarily a free half-segment must exist, indicated for the sake of brevity as the semi-segment *I $\alpha$* .

At the end of this communication the question was raised, to what phenomena the activation of the osteogenetic potency, doubtlessly existing in this semi-segment, would give rise, and the provisional answer to this question was, that, in my opinion, it would probably be possible to trace a relation between the established existence of the semi-segment and a series of phenomena in the cranio-vertebral

region, namely the atlas-variations, the Pro-atlas of ALBRECHT, the *concrecentia atlanto-occipitalis* and the manifestation of the occipital vertebra.

In this second communication I intend to trace the signification of the existence of the semi-segment for the morphological explanation of the atlas-variations.

The fact that I wish to discuss in the first place these atlas-variations finds its foundation among others in the circumstance that it is just the study of these variations that has been the nearest inducement to state the existence of the semi-segment Ia described in the previous communication.

In the description of the human atlas it is always indicated, that the most lateral part of the arcus posterior, namely that part that borders immediately on the *massa lateralis* is characterized by a notch. This notch, called *sulcus arteriae vertebralis*, is caused by the *arteria vertebralis*, which after having passed through the *foramen transversarium atlantis* bends behind the *massae laterales* and crosses the arcus posterior together with the first cervical-nerve, before it pierces the *membrana atlanto-occipitalis*. The degree of development of this notch shows a great deal of variability. Now it is flat and shallow, now one sees that it has been transformed into a channel shut off from all sides, because an osseous bridge extends itself from the posterior rim of the *massae laterale* to the upper-rim of the arcus posterior, so that one must then speak of a *canalis* or *foramen arteriae vertebralis*. This latter condition occurs frequently, witness the fact, that nearly all text-books call the attention to it in their descriptions of the atlas.

The nomenclature, however, of this variation, both of the osseous bridge, mentioned above, and of the channel or foramen the cranial border of which is formed by the bridge, varies so very much, that it is almost as arbitrary to find out oneself a name for it, as to make a choice from the numerous existing names. In my opinion *foramen atlantoideum posterius* (BOLK) and *foramen arcuale* (GAUPP) are the simplest among the denominations of the above-mentioned foramen. I shall call the osseous bridge over this foramen *ponticulus posterior*.

Beside this variation of the human atlas a second is known, which occurs less frequently. It consists herein, that from the lateral side of the upper-rim of the *massa lateralis* an osseous bridge extends to the most lateral part of the upper-rim of the *processus transversus atlantis*. Here is consequently the *arteria vertebralis* bridged by a bone, now together with the *ramus anterior* of the

first cervical nerve, and in this way a short channel or ring-shaped opening is formed. To indicate this opening BOLK uses the name of foramen atlantoideum laterale, whilst GAUPP proposes to borrow the denomination that the veterinary surgeons (ELLENBERGER and BAUM) give to its homologon, constantly occurring with many animals, the foramen alare. The osseous bridge that shuts off this foramen at the top I call ponticulus lateralis.

As I remarked already previously both variations are known in literature. LE DOUBLE<sup>1)</sup> indicates the frequency of the foramen atlant. posterior and the ponticulus lateralis as 11.7% that of the foramen atlantoideum and the ponticulus lateralis as 1.8%.

In the collection of atlases of the Anatomical Laboratory in Amsterdam, I found among 3360 atlases 77 or 2.3% with foramen atlantoideum laterale and 355 or 10.6% with foramen atlantoideum posterius. The numbers resulting from the examination of this material, which is at least twice as large as the complete collective tables from which LE DOUBLE calculated his percentage do consequently not considerably deviate from the latter.

The simultaneous occurrence of these two variations at the same atlas has a.o. been described by BOLK<sup>2)</sup>, who found a combination of a foramen atlantoideum laterale and a bilateral foramen atlantoideum posterius on the right side.

LE DOUBLE (l.c.s.) mentions likewise a case in which on the right side the two foramina with the ponticuli belonging to them were simultaneously present.

From the material that was at my disposal, I could select a series, in which all imaginable coincidences occur, as appears from the following summary:

	For. atl. lat.	bilateral	For. atl. post.	bilateral	with 2 specimens
1.					
2.	to the left				2
3.	to the right				1
4.	to the left	bilateral			3
5.	to the left				4
6.	to the right				3
7.	to the right	bilateral			6
8.	to the left				3
9.	to the right				5
10.	missing	lateral			124
11.	to the left				124
12.					107

<sup>1)</sup> LE DOUBLE. Les variations de la colonne vertébrale.

<sup>2)</sup> L. BOLK. De variaties in het grensgebied tusschen hoofd en halswervel-

The two most remarkable cases of this series are doubtless the two specimina mentioned first, as to my knowledge they have not yet been described. One of them is represented in Fig. 1.

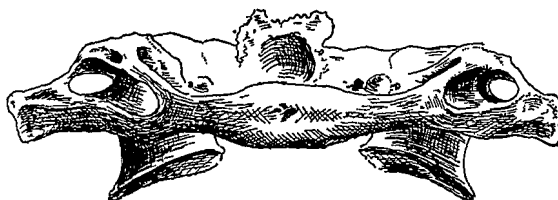


Fig. 1.

Atlas with bilateral ponticulus lateralis and bilateral ponticulus posterior.

Rises the question about the morphological signification of these variations.

Among the investigators that have tried to give an answer to this question, there are especially three, who claim the attention here, viz. LE DOUBLE, BOLK and DE BURLET.

LE DOUBLE explains the occurrence of the above-described ponticuli posteriores simply mechanically and regards it as ossification of a ligament, which in most cases is found between the upper-posterior-rim of the massae laterales and the upper-rim of the most lateral part of the arcus posterior atlantis. This ossification would take place under the influence of the pulsations of the arteria vertebralis.

In consequence of the curving of this artery at this place the convexity of which is directed backwards, every pulse-gulf would push the above-described ligament backward; thereby a traction would be occasioned on the periost of the atlas on the spot where the ligament is fastened and under the influence of the stimulus the osteogenetic potency of the periost would be increased. LE DOUBLE cites, as an explanation of the occurrence of the ponticuli laterales, an ossification of a ligament occasioned by the same causes.

It seems to me very improbable that the cause of the formation of the mentioned variations is to be found in the pulsations of the A. vertebralis. In the first place it is very improbable that a so typical variation should exclusively be dependent upon outward circumstances, the more so, as these circumstances are pretty well constantly existing, and the frequency of the variation, though not unimportant, is after all not so great as might be expected in

kolom bij den mensch en hunne beteekenis. Nederl. Tijdschr. v. Geneesk. 1899 Dl. I, II, 1900. Dl. I.

L. BOLK. Zur Frage der Assimilation des Atlas am Schädel beim Menschen. Anat. Anzeiger Bd. XXVIII.

accordance with the pretty well constant occurrence of the above-mentioned ligaments and the not less constant pulsation of the A. vertebralis. There are however still other considerations that, in our opinion, make LE DOUBLE'S explanation appear less acceptable. Suppose even that the stimulus of the periost caused by the pulsation of the A. vertebralis should in reality be the cause of the occurrence of the ponticuli posteriores and laterales, then it would at all events be at least astonishing that the results of this process, naturally somewhat slow, could already be observed at a youthful age, and yet this is the case, as I have been able to ascertain with several atlases of the collection I have examined. The extraordinarily powerful way, in which in many cases both the ponticuli posteriores and the ponticuli laterales can be developed make us likewise doubt the correctness of LE DOUBLE'S explanation of the discussed variations, the more so, as it is generally known, that osseous tissue reacts on the pulsations of the vesselwall rather with atrophy than with hypertrophy.

This doubt becomes still greater if we also consider the results of comparative anatomical investigation which were also known to LE DOUBLE. For then it appears that with many groups of mammals, and among these also primates, the ponticuli and foramini, occurring with man only as variations, are constant and normal parts of the atlas.

BOLK has laid, as far as it regards Primates, a stress upon this fact, which was already known to MERKEL. He demonstrates that namely the normal human atlas has been developed by reduction from the more complete form, as it is met with among Primates a.o. with Cynocephalides. This reduction regards in the first place the topmost limitation of the canalis arteriae vertebralis, with Cynocephalides still completely extant, of which first the most lateral part (the ponticulus lateralis) afterwards also the medial part (the ponticulus posterior) disappears, by which process the channel is changed into a notch.

The repeated occurrence of these ponticuli must consequently most probably be regarded as a common atavism; ponticulus posterior and ponticulus lateralis are with the human atlas regressive variations. According to this notion the signification of this variation is in comparison with LE DOUBLE'S view a quite different one. The principal cause of its occurrence is now not to be found in outward circumstances, however favourable their influence may for the rest be upon the process, but in a generally occurring inclination of reproducing phylogenetically older forms.

If we desist from trying to give an answer to the question after the influences that have brought about the reduction of the human atlas in the above-mentioned parts, the interpretation of the reoccurrence of the ponticuli laterales and posteriores as regressive variation gives certainly a satisfactory explanation of this phenomenon, as entering upon further details of the problem would immediately lead us to the department of general biology and specially to that of the phenomena of heredity.

The way in which DE BURLET<sup>1)</sup>, the third of the above-mentioned investigators, has treated the problem differs principally from that of the former. In the views hitherto reproduced there was only an attempt to answer the question after the signification and the origin of the ponticuli posteriores and laterales with the human atlas.

DE BURLET puts the question in a different way by taking likewise into account with this question the homologa of these elements, as they constantly occur — as has already been mentioned — with many mammals. By doing so the problem assumes a more general nature, and may be formulated as follows:

“What is the signification of the foramen arcuale and alare of the mammal atlas and of the parts lying cranially from it?”

When answering this question DE BURLET points out the possibility that the arcus posterior atlantis should not be equivalent to the arcus posterior of the other vertebrae, in this sense namely, that foreign elements lying originally cranially from it should have assimilated with the arcus posterior atlantis, and as original source of these elements he indicates the so-called proatlas.

I cannot treat DE BURLET's view completely within the compass of this communication. The notion proatlas has in the course of time gradually been modified and is even now by no means accurately defined, so that an effectual discussion of DE BURLET's view that the ponticulus posterior and lateral might be homologised with the proatlas requires necessarily an accurate definition of the proatlas. I hope to do so in a subsequent communication, which will be entirely devoted to the Proatlas-problem; now I can, whilst explaining my own view, only enter upon DE BURLET's opinion in so far as he admits the possibility that elements having originally extended cranially from the arcus posterior atlantis should have assimilated with it, and the posterior arch of the atlas should consequently not be homologous with the posterior arch of the other vertebrae.

<sup>1)</sup> DE BURLET. H. M. — Ueber einen rudimentären Wirbelkörper an der Spitze des Dens Epistrophei bei einem Embryo von *Bradypus cuculli*. Morphol. Jahrb. Bd. XLV. H 3.

In order to examine in how far the possibility expressed here is likewise a reality, we ought in the first place to remember what has been said in the previous communication on the metamerological signification of the cranio-vertebral interval about the metamere relation of the vertebrae.

From the generally admitted and in fact ascertained law of the re-segmentation of the vertebral column we have then deduced that in general the  $n^{\text{th}}$  vertebra has been constructed from the caudal half of the  $n^{\text{th}}$  scleromere and the cranial half of the  $(n + 1)^{\text{th}}$  scleromere, so that the metamere formula of the vertebrae is  $V_{(vertebra)} n = S n b + S (n + 1) a$ .

If now we admit that the atlas, with regard to its metamere relations, is entirely equivalent to the other vertebrae and that consequently the above-mentioned formula likewise holds good for the atlas, then follows from it necessarily (supposing  $n = 1$ ), that the atlas would be constructed from the caudal half of the first segment and the cranial half of the second one.

Let us now regard in this connection the position of the ponticuli posteriores and laterales.

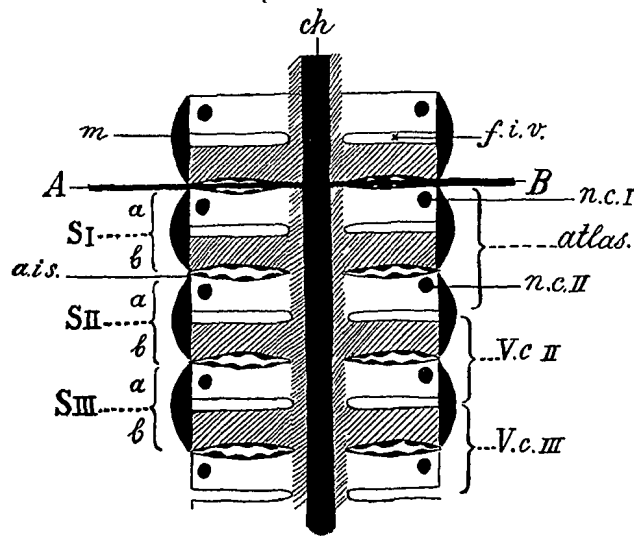


Fig. 2.

Ch = chorda m = myotome; AB = cranio-vertebral interval;  
S I = 1st Segment; S II = 2d Segment, etc. a = cranial  
semi-segment; b = caudal semi-segment; n. c. I = 1e cervical-  
nerve; v. c. II = axis.

To the nature of the ponticuli belongs that they form the cranial extremity resp. of the foramen arcuale and of the foramen alare, through which foramina the first cervical nerve passes. Both the ponticuli are consequently always situated cranially from this first cervical-nerve. Fig. 2 however teaches us, according to the law,



that the spinal-nerve is always situated in the cranial half of the sclerotome to which it belongs, that the first cervical-nerve does not belong to the semi-segments from which the atlas is constructed, at least not, if we maintain that the atlas is equivalent to the other vertebrae and that its formula is  $SIb + SIIa$ . If now the 1<sup>st</sup> spinal-nerve is situated in the cranial semi-segment  $Ia$ , as is in every respect confirmed by investigation, then a fortiori the ponticulus lying cranially from this nerve must be reckoned to the same semi-segment, at all events most certainly not to the caudal semi-segment  $Ib$ . If consequently a ponticulus is present, then it follows necessarily from the fact, that the ponticulus has been formed in the cranial semi-sclerotome  $Ia$  (it remains separated from the caudal half of the last sclerotome of the cranium by the cranio-vertebral interval situated intersegmentally) that indeed the atlas is no longer equivalent to the other vertebrae, but is constructed instead of 3 semi-sclerotomes and not of 2 and consequently the formula must run:  $SIa + SIb + SIIa$ .

Hereby an answer is given both to the question put by DE BURLLET after the signification and the origin of the ponticuli posteriores and laterales, occurring with man as a variation and with many mammals constantly, and in the first instance to the question formulated in the beginning of this communication, if activation can occur of the osteogenetic potency of the "free" semi-segment  $Ia$ , and if so, to what phenomena this activation will give rise.

The answer to the first question must be that, on account of the existence of the Ponticuli posteriores and laterales, the atlas may most decidedly not be called equivalent to the other vertebrae, but that, in comparison with the other vertebrae, it has enlarged itself, as was likewise supposed by DE BURLLET by assimilation of a cranially lying element originating in the semi-segment  $Ia$ .

The answer to the second question must be, that activation of the osteogenetic potency of the semi-segment  $Ia$  is doubtlessly possible, and that one of the phenomena, by which this activation is characterized, consists in the occurrence of the ponticuli posteriores and laterales, which limit cranially the foramina arcualia and alaria. We can imagine this process thus, that in that region of the semi-segment  $Ia$ , that corresponds with the arcus posterior vertebrae (the region of the body of the vertebra remains for the present out of discussion) on account of the influence of the ossificating potency existing in it, an osseous arch is formed, be it usually only weak, which assimilates with the arcus posterior atlantis and leaves, when doing so, a necessary opening for the passage of the n. cervicalis I and the a. vertebralis, the foramen arcuale. The

same holds for the region of the processus transversus. There is likewise formed in the semi-segment Ia an osseous piece connected with the osseous arch in the region of the arcus posterior, which, whilst leaving the required room for the passage of a. vertebralis and ramus anterior n. cervicalis, (foramen alare) assimilates with the processus transversus.

If this representation is correct, it is self-evident to admit, that besides the above-mentioned ponticuli other elements can be indicated in the dorsal region of the atlas, which must be reduced to the semi-sclerotome Ia. Hereby I have especially in view the cranial half of the massae laterales and the central part of the arcus posterior, situated between the place of insertion of the ponticuli posteriores into the posterior arch. With regard to the massae laterales we need only pay attention to the fact, that both the ponticuli originate at its upper-resp. posterior and lateral rim, and that this place of origin resp. the part of the massa lateralis projecting most posteriorly and laterally is likewise always situated cranially from the 1<sup>st</sup> spinal-nerve; for on this spot we see, with somewhat strong development, the two ponticuli assimilate into each other. Consequently we are compelled to admit that here also is a part lying in the most cranial region of the massae laterales, which just like both the ponticuli has originated from the semi-segment Ia. A difficulty however presents itself here for fixing the boundary-line between the regions of the semi-segments Ia and Ib. There was no difficulty in this respect for the ponticuli, as all that lies cranially from the first spinal-nerve i.e. over the foramen arcuale or alare does certainly not belong to Ib., and there is not a single inducement to admit that anything of the region lying caudally with regard to that nerve, should belong to the semi-segment Ia. Here however it is different, the massae laterales show neither with the full-grown atlas nor with the young one a relief of any morphological signification, as the for. arcuale or the for. alare doubtlessly is, and that would allow to indicate the boundary-line between the semi-segment Ia and Ib. We can consequently say indeed, that in all probability part of the massae laterales still belongs to the semi-segment Ia, for the present it is however impossible to say which part belongs to it.

For the above-mentioned central part of the arcus posterior it is easier. Also in this region it is, as we saw, a priori probable, that the activation of the osteogenetic potency of the semi-segment Ia does not remain restricted to the ponticuli posteriores and laterales, but extends itself between the points of insertion of the ponticuli into the arcus posterior, and consequently forms an in the median

line uninterrupted osseous arch. As a rule the boundary-line between the regions belonging to SI $\alpha$  and SI $\beta$  cannot be observed here, no more as with the *massae laterales*, for the simple reason that no passage required for nerve or bloodvessel keeps the regions separated.

It seems to me to be here the place to fix the attention to peculiarities occurring rather frequently at the ossification of the posterior arch of the atlas. In some cases namely one sees either in the median line, or immediately on either side of it, openings in the arcus posterior. The occurrence of these foramina is not entirely unknown. LE DOUBLE mentions them in his repeatedly cited work, when he says on p. 88 that sometimes the tuberculum posterior atlantis is replaced "par une dépression plus ou moins profonde, dans laquelle on trouve par exception un foramen minuscule, qui est l'origine d'une canalicule, qui s'ouvre en avant dans la cavité rachidienne". The author does however not attach any signification to it, nor does he try to give an explanation of it.

The mentioned opening, which might be distinguished as foramen arcuale medianum or mediale, occurs rather frequently in those atlases, where the process of ossification is not yet completed, but it is not entirely wanting in the normal, well developed atlas, as I could ascertain in the material examined by me. Usually, as likewise LE DOUBLE indicates, the variation remains restricted to a depression lying in the region of the tuberculum posterius, now of a fantastical shape, now, and this rather frequently, in the form of a rather deep notch running transversally, the two extremities of which are still a little deeper. In fig. 3, 4, and 5 I have represented some forms of this variation, as I found them in full-grown atlases



Fig. 3.  
Atlas with foramen arcuale medianum.

among the material examined by me, Fig. 3 represents an atlas, in which the for the rest strongly developed arcus posterior shows in the median-line a round opening (foramen arcuale medianum) lying in a little cavity. In fig. 4 we find the representation of an atlas, the posterior part of which is characterized by a transversal notch extending over a rather large distance. In the bottom of this notch we find on either side of the median-line an opening (foramen

arcuale) which is considerably larger on the left side than on the

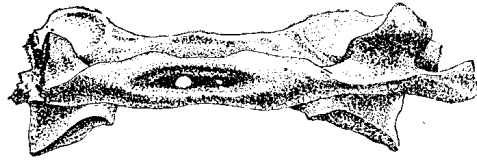


Fig. 4.

Atlas with foramina arcualia medialis.

right one, and at last Fig. 5 gives us the representation of an atlas, which is already remarkable on account of the existence of a strongly developed bi-lateral ponticulus posterior, but which shows moreover an extraordinary deep depression (*impressio mediana arcus posterioris*) lying in the centre of the arcus posterior, a piercing of the posterior arch as in the specimens represented in fig. 3 and 4 is however not found here.

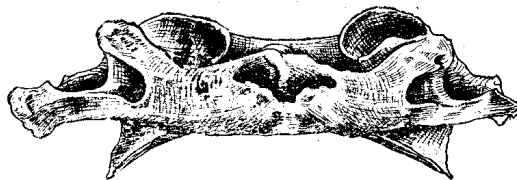


Fig. 5.

Atlas with *impressio mediana arcus posterioris*.

In the occurrence of these variations, to which till now but little attention has been paid, I suppose, I may see a proof for the view described above and a priori probable, that also the central part of the arcus posterior atlantis contains elements that must be reduced to the above-mentioned semi-segment *Ia*. In that case the notch running transversally, and the foramina arcualia medialis or mediana, eventually occurring in it, would indicate the boundary-line between semi-segment *Ia* and semi-segment *Ib*.

If this supposition agrees with the actual fact, it follows from what has been said, that also in case the ponticuli posteriores and laterales have not developed, as is most frequently the case with man, the atlas cannot be called equivalent to the other vertebrae, but that also in normal circumstances it has been built of elements belonging to 3 semi-segments.

I have projected Fig. 6 (p. 212) in order to give a concise survey of the manner in which I conceive the part that the semi-segment *Ia* has in the construction of the atlas with the variations described

above, in proportion to the degree of the activation of the osteogenic potency contained in it.

The figure represents 4 human atlasforms *A*, *B*, *C*, and *D*. The parts that have originated with certainty from the semi-sclerotome *Ia* are represented black; those of which this is very probable and for which in many cases the region of extension can be limited are hatched.

*A* gives the scheme of the normal atlas without any variation. We find in it, as belonging with great probability to the semi-segment *Ia*, the most cranial part of the central part of the posterior arch.

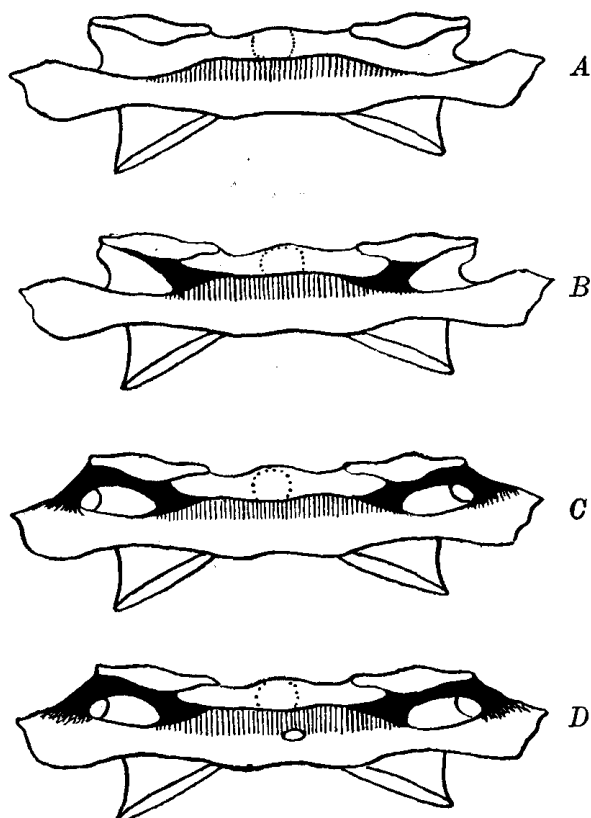


Fig. 6.

In *B* we find the ponticuli posteriores occurring bi-laterally represented black; the part of the arcus posterior lying between the two places of insertion of the ponticuli into the posterior arch is hatched as in *A*. The part of the atlas belonging to semi-segment *Ia* represents now an arch lying between the posterior rim of the massae laterales and assimilated with it and with the central part of the arcus posterior.

*C* differs from the preceding form only by the occurrence of the ponticuli laterales, likewise represented black, by which the osseous

arch originating from semi-segment *Ia* has been enlarged in a lateral direction; whilst in *D* the foramen arcuale medianum is indicated as the very probable natural limitation of semi-segment *Ia* opposite to semi-segment *Ib*.

*A* indicates consequently the minimal degree, *D* the maximal degree of activation of the osteogenetic potency in the semi-segment *Ia*.

On purpose I have not represented in these schemes the share that semi-segment *Ia* would have in the structure of the massae laterales. As long as this part of the atlas does not show a relief, by which we could indicate the boundary-line between the semi-segments *Ia* and *Ib*, I do not think myself justified to insert it in a scheme, however probable the view may be theoretically.

Briefly expressed the following has been demonstrated in this communication :

1<sup>st</sup>. As was ascertained by BOLK, we have to see in the occurrence of ponticuli posteriores and laterales in the human atlas nothing else than an atavistic variation, as the form of the atlas occurring normally with man has originated by reduction from the mammal-atlas, in which the mentioned ponticuli usually occur constantly.

2. The ponticuli posteriores and laterales, whether they occur as a variation, as with man, or are constant, as with most of the mammals, belong to the semi-segment *Ia*

In all cases in which the mentioned ponticuli are extant, the atlas is certainly not equivalent to the other vertebrae, as the formula for the atlas must then be  $SIa + SIb + SIIa$ . Consequently DE BURLET's supposition that elements that originally were situated cranially, have assimilated with the atlas, is correct.

3. The variations of the atlas designated as foramina arcualia medialia or mediana are most likely the proof, that also the part of the arcus posterior, in so far as it is situated cranially from the mentioned foramina, extending between the two places of insertion of the ponticuli posteriores must be reduced to the semi-segment *Ia*.

4. The fact that the two mentioned ponticuli belong to the semi-segment *Ia* is the proof, that activation of the osteogenetic potency existing in this semi-segment is possible.

**Mineralogy.** — “*On phosphorite of the isle of Ajawi*”. By Prof. A. WICHMANN.

(Communicated in the meeting of May 29, 1915).

The isle of Ajawi or Mios Kairú, situated at  $0^{\circ}16\frac{1}{2}'$  S. Lat. and  $135^{\circ}5'$  E. Long. northwest of the Schouten Islands was discovered on Febr. the 15<sup>th</sup> 1700 by WILLIAM DAMPIER. When he intended to sail between this island and the neighbouring isle of Aifondi he scarcely escaped being shipwrecked. This fortunate escape induced him to call this group the Providence Islands<sup>1)</sup>. Though it was afterwards often enough seen, Ajawi was never visited by Europeans. When the New Guinea Expedition of 1903 was on their way to the Mapia Islands, they were of opinion that they should not let the opportunity pass by to take likewise a view of this isolated island.

After Aifondi was left in the morning of the 19<sup>th</sup> of July by the government steamer “Zeemeeuw”, Ajawi was reached after 3 $\frac{1}{2}$  hours' steaming. Already from a distance it appeared that the island, covered with forests, was low, but that the eastern part was formed by rocks of a phantastic shape. At about 2 km. distance from the south-coast the ship cast anchor in 13 fathoms, whereupon the yawl took all the participants to the south-west-corner. This part, rising hardly 3 m. above the level of the sea, consists of coral sand with blocks of coral besides boulders of a white rather gross-grained and hard but porous limestone which contains, according to L. RUTTEN, numerous specimens of *Rotalia*. They call the attention to the fact that the rock must be considered as subrecent<sup>2)</sup>. The ground is covered by a thin forest, consisting of specimens of *Pandanus*, about 16 m. high, in which enormous flocks of the beautiful Nicobara pigeons (*Caloenas nicobarica*) nestle<sup>3)</sup>. There were no human inhabitants and from the absence of coconut-palms the conclusion may be drawn, that permanent settlements have never existed.

In the eastern and north-eastern part of the island compact limestones occur, which however differ from the above-mentioned ones.

<sup>1)</sup> A Voyage to New Holland, etc. in the year 1699. A Collection of Voyages 3d ed. 3. London 1729, p. 195. On the map Ajawi was indicated as Little Providence and Aifondi as Great Providence.

<sup>2)</sup> Foraminiferen-führende Gesteine von Niederländisch Neu-Guinea. Nova Guinea 6. 2. Leiden 1914, p. 30.

<sup>3)</sup> Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Kolonien. Bulletin No. 46. 1903, p.p. 35—36. — H. A. LORENTZ, Eenige maanden onder de Papoea's. Leiden 1905, p p. 201—202.