oscillations of this kind than meteorological observations made at tropical stations.

If the outcome arrived at by the arrangement of barometric daily means for Batavia is considered to afford some evidence or indication for an oscillation periodic in 25.80 days, a much greater probability must be attached to the real existence of this fluctuation in the observations of magnetic declination made at Greenwich.

Anatomy. — *"On the Form of the Trunk-myotome."* (First Communication). By Prof. J. W. LANGELAAN. (Communicated by Prof. T. PLACE).

The segmented plan of construction of the vertebrate animals, most marked in the muscular system, has led to the conception of the myotome.

Two methods are chiefly employed in establishing the form of this myotome. The first method is based on the hypothesis of the primary connection between muscle and nerve; the second, a more direct one, is based on the dissection of the intersegmental tissue. Both methods seem equally restricted in their application, as can be concluded from the researches of BARDEEN [1]), moreover there is reason to believe, that they will not always yield concordant results.

The second method is followed in this research.

I. *Trunk-myotome of Petromyzon fluviatilis.* (Fig. 1).

The trunk-myotome of the adult animal has in general the form of a crescent, the cornua being directed towards the cranial end of the body and slightly inclined to each other. The dorsal cornu (fig. II *CD*) reaches to the mid-dorsal line, while the ventral cornu (fig. II *CV*) ends at the mid-ventral line of the body. Both cornua differ in length, the dorsal being about $^1/_7$ longer than the ventral, and while both reach to the mid-plane of the body, they are slightly torquated in respect to each other.

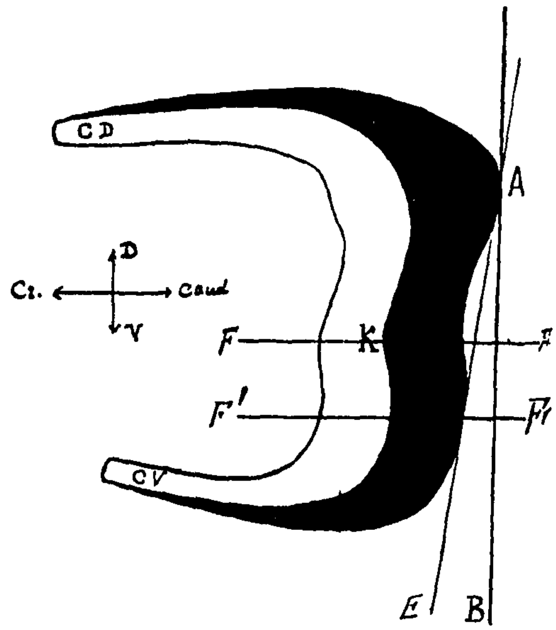
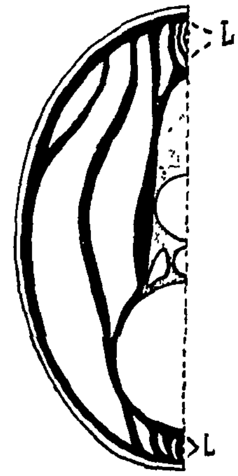


Fig II.

1) Anat. Anz. Bd. XXIII, N⁰. 10/11.

The corpus of the myotome shows a kneelike inflection (fig. II *K*), which is always situated nearer the mid-ventral line of the body than the mid-dorsal line. In transverse section (along the line *FF*, fig. II) the corpus of the myotome is rhomboidal, this rhombus being more and more flattened towards the cornua; consequently the cornua appear in transverse section as lamellae in juxtaposition (fig. III *L.L.*). These lamellae are slightly incurved.

Fig. III.



Transverse section through the trunk of Petromyzon; the inter-segmental tissue being black.

One side of the rhombus lies in the body surface (black in fig. II). This surface is cylindrical in the middle region of the body, the transverse section being perfectly elliptical. The black-coloured surface of the myotome, must therefore be considered as cut out of this cylindrical surface.

The opposite side of the rhombus is turned towards the skeletal-axis and the abdominal cavity. In general it has the same form as the outer side, being only slightly excavated by the abdominal cavity, which in this part of the body is cylindrical, the transverse section being a perfect circle. Both the other sides of the rhombus are congruent and bound respectively, a more cranial and a more caudal myotome.

The position of the myotome as a whole in respect to the sagittal plane, passing through the mid-lines of the body, is such, that the corpus shows an inclination towards the caudal end of the body. Seen in transverse section (along the line *FF* fig. II) the longest axis of the rhombus makes an acute angle with the sagittal axis of the body, the vertex of the angle being turned towards the head. This caudal inclination of the myotome diminishes towards the cornua, so that the cornua are nearly normal to the surface of the body. In consequence of this caudal inclination the myotomes overlap to some extent. This muscular overlapping varies between $^1/_2$ and $^2/_3$ in the neighbourhood of the knee, diminishing towards the cornua on account of the decrease of the caudal inclination of that part of the myotome.

The position of the myotome in respect to the dorsoventral axis is variable along the body. If *AB* (fig. II) is a dorsoventral axis, at right angle to the sagittal axis, and *AE* a line tangent to the dorsum of the myotome, then we have in the angle *AEB* a measure for the ante- or retroversion of the myotome in respect to the dorsoventral axis.

The first myotomes behind the last branchial cleft, show a little

3*

anteversion, which quickly decreases, so that the 4th and 5th myotomes are strictly vertically situated. The following myotomes (as in figure II) are retroversed, this retroversion reaching a maximum of 10°. Towards the caudal end of the body this retroversion decreases and is again reversed behind the anal aperture, where the myotomes are again anteversed.

The description given here of the myotome applies only to the trunk-myotome in the middle region of the body, the branchial apparatus as well as the appearance of the dorsal fins bringing about notable changes in this form.

II. *Trunk-myotome of Acanthias vulgaris. (Fig. IV and V).*

The myotome described in this paper was situated in that region of the body which lies between the thoracic fin and the first dorsal

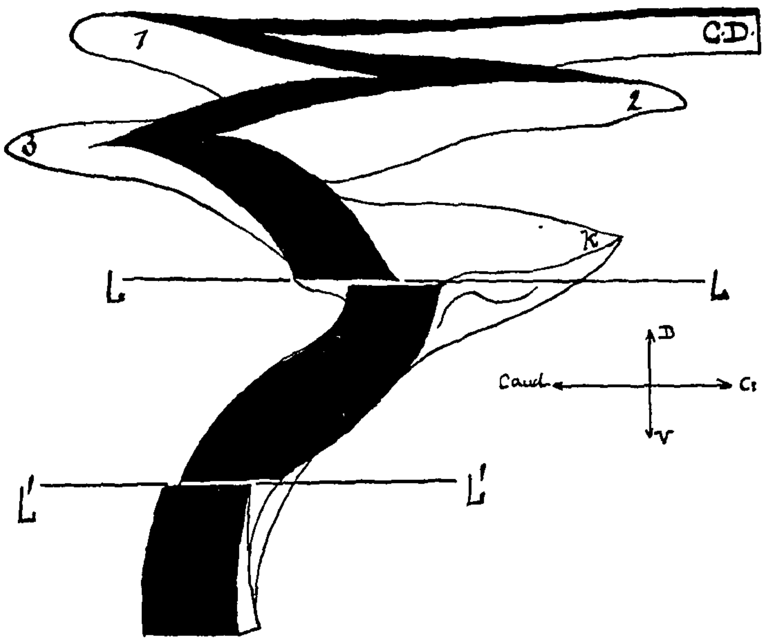


Fig. VI.

fin. In its most general features the trunk myotome of Acanthias shows a great resemblance with that of Petromyzon, though at first view a considerable difference seems to exist.

Looking at that surface of the myotome, which forms part of the surface of the body, we see it interrupted in two places.

The lines of interruption are nearly parallel to the sagittal axis of the trunk. The first line (*LL* fig. VI) coincides with the linea lateralis, the second (*L'L'* fig. VI) lies nearer the mid-ventral line of the body. At the place of interruption septa of connective tissue descend and seem to divide the myotome into three parts. One part situated between the mid-dorsal line and the line *LL* is the dorsal part of the myotome; between the lines *LL* and *L'L'* lies the lateral and between the latter and the mid-ventral line, the ventral part of the myotome is situated.

Considered at the line of interruption, the surface of the lateral part of the myotome seems to be cranially displaced in respect to the dorsal part; this displacement amounts to one half of the breadth of the myotome. The same can be observed between the surface of the lateral and the ventral part of the myotome, the lateral part being also displaced cranially in respect to the ventral part; this displacement does not surpass $^1/_3$ of the breadth of the myotome.

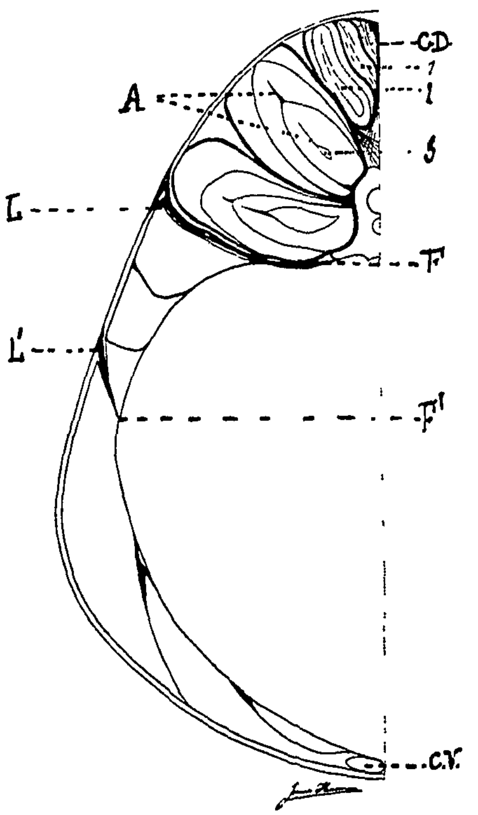
If we follow the septa of connective tissue at the line of interruption *LL*, it is easily seen, that the myotome is rolled in towards the axis of the body and then reversed till it reaches again the body surface. In most cases the continuity of the muscular tissue at the bottom of the fold is broken off, but the intersegmental tissue which covers the myotome is always continuous. If we now try to unroll the myotome as much as possible, we find that the dorsal part makes an angle with the lateral part, so that a true knee is formed. The top of the knee is directed towards the head as in Petromyzon. The line along which the myotome is folded in, is parallel to the sagittal axis of the body, and seems to run over the knee, so that the top of the knee lies at the point *K* of figure VI.

The same can be observed on following the line *L'L'* (fig. VI), the line of folding being also parallel to the sagittal axis of the trunk.

The differentiation of the myotome into three parts, ensues therefore from a process of infolding, the lines of folding being parallel to the sagittal axis of the body.

If a model of the myotome of Petromyzon is cut out of paper, and this myotome folded in along the lines *FF* and *F'F'* (fig. II), we get a precise illustration of the displacements seen in the myotome of Acanthias. The direction in which the outer-surfaces are displaced in respect to each other is a direct consequence of the form and the curvature of the myotome at the places of infolding. The difference in the extent of the displacement of the surfaces along the lines *LL* and *L'L'* (fig. VI) is due to the fact, that the fold along the line *FF* is longer in the direction from outwards to inwards in correspondence with the dimensions of the myotome. This can be seen in a transverse section through

Fig. VII.



Transverse section through the trunk of Acanthias; the intersegmental tissue black. Natural size.

the same region of the trunk of Acanthias, where *LF* (fig. VII) is the intersegmental tissue that divides the dorsal from the lateral part, while *L'F'* is the septum, that the latter separates from the ventral part of the myotome.

The further differentiation of the dorsal part of the myotome takes places by the same process; the lines of folding instead of being parallel to the sagittal axis of the body are in general at right angles to this axis.

There are three of these lines, agreeing with the number of peaks which the dorsal part of the myotome shows. These lines considered from outwards to inwards, are originally normal to the surface of the body, then curved with the convex side turned ventrally and towards the body surfaces. This curvature is most marked in the third line of folding (*A* fig. VII), reckoned from the mid-dorsal line, the first one being nearly a straight line normal to the body surface and to the sagittal axis. These lines of folding are visible on a transverse section, because septa of intersegmental tissue stretch out into the fold. The curved lines (*A* fig. VII) are the transverse sections of these septa.

The lateral part of the myotome shows no further differentiations.

The ventral part has only one line along which the folding of the myotome is well marked; consequently this part of the myotome shows only one peak turned to the caudal end of the body.

The myotome considered as a whole, as in Petromyzon, has a caudal inclination. This inclination is most marked at the knee. Considering only the dorsal part, we see this inclination diminish towards the mid-dorsal line, so that the most dorsal part of the myotome is about normal to the surface of the body. This most dorsal part is elongated into a dorsal cornu (*CD* fig. VI). In transverse section we find therefore these dorsal cornua as lamellae in juxtaposition (fig. VII *CD*).

When the direction of the myotome is reversed at a line of folding, the same happens with the sense of the inclination, so that these parts show a slight cranial inclination. The folding of the myotome together with the inclination produces the elongated and peakshaped form of the myotome at these lines of folding. The myotomes thus cover each other as hollow, pointed tubes telescoped into each other. In the transverse section (fig. VII) 1 indicates the section of the first peak directed caudally, 2 the peak turned towards the head and 3 the second peak turned to the caudal end of the body (fig. VI resp. 1, 2, 3). In consequence of the inclination of the dorsal part of the myotome, these lines of folding are not quite at right angles to the sagittal axis, but are also slightly inclined. This is the reason why we find only part of these lines in a transverse section, which is normal to the sagittal axis.

From a transverse section we can judge the extent of the muscular overlapse. Concordant with the increasing inclination from the mid-dorsal line to the first lateral line, we see the overlapse increase to about $^3/_4$. At the knee the inclination rapidly decreases. In the lateral part of the myotome the inclination is insignificant and the overlapse less than $^1/_2$. In the ventral part the inclination increases at first and then decreases towards the mid-ventral line; the muscular overlapse does not surpass $^1/_2$. The ventral part terminates at the mid-ventral line in a ventral cornu (*CV* fig. VII, fig. V) turned cranially. This ventral cornu is much shorter than the dorsal cornu.

In order to get some idea of the dimensions of the myotome I have measured the length of each of the three parts into which the myotome is divided up. These measurements have been made over the surface of the myotome and this surface was also followed where it is folded in. In this way I have found for the myotome described:

Length of the dorsal part 350 mm.; the lateral part 90 mm.; the ventral part 190 mm. The length of the whole myotome is therefore 630 mm. and of this $^{55}/_{100}$ belong to the dorsal region.

I have made the same measurements in the myotome of Petromyzon. If it be conceded that the points *K* (fig. II and fig. VI) where the knee is located in both myotomes, are corresponding points, I have found: Length of the dorsal part, from the mid-dorsal line to the knee 33 mm.; the latero-ventral part, from the knee to the mid-ventral line, 26 mm. The whole length of the myotome was therefore 59 mm., and of this also $^{55}/_{100}$ is contributed to the dorsal region.

If we compare the dorsal region in Petromyzon and in Acanthias, it is evident that this region is strongly reduced in the latter; notwithstanding this, the same part of the whole myotome belongs in both cases to the dorsal region. If this be true in general, it seems to me, that the reduction of the dorsal region is the principal moment which has led to the folding of the dorsal part of the myotome.

In figures IV and V the position of the rib, in relation to the myotome, is indicated by a crossed line. The rib is located in the intersegmental tissue that divides the dorsal from the lateral part of the myotome. The junction of the rib with the skeleton, lies a little caudally in respect to the knee of the myotome; the rib itself is turned to the caudal end of the body concordant with the caudal inclination of the myotome. In a transverse section, three successive ribs are cut through.

Geology. — *"On the direction and the starting point of the diluvial ice motion over the Netherlands."* By Prof. Eug. Dubois. (Communicated by Prof. J. M. van Bemmelen).

Referring to the *"Beschrijving van eenige nieuwe grondboringen," V*, by Dr. J. Lorié, recently published in the "Verhandelingen der Koninklijke Akademie van Wetenschappen, 2de Sectie, Deel 10, N°. 5", to which, on p. 20 and 21, the author has added a critique of some conclusions in my communication to the Academie: *"The geological structure of the Hondsrug in Drenthe and the origin of that ridge"* (Proceedings of the meeting of Saturday, June 28, 1902, Vol. V, p. 93 sqq.), I beg leave to make the following remarks.

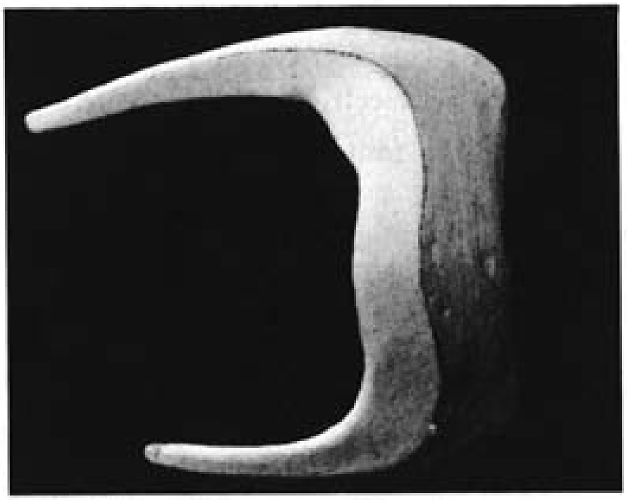
The critique of that eminent student of the geology of the Netherlands is based on such an incorrect and incomplete statement of my conclusions and of the facts, that the reader cannot but regard those conclusions as being of a rash character, which in fact they have not.

Indeed, having said that he does well agree with my opinion regarding the structure of the Hondsrug, Dr. Lorié continues as follows [1]:

"Another case it is with a particularity mentioned on p. 4 and 5". (This refers to 12 lines on p. 96 and 97 of the Proceedings.) "In pit XLI there was found a boulder of quartzite, having a diameter of 0.35 M., cleft into two pieces, in such a manner

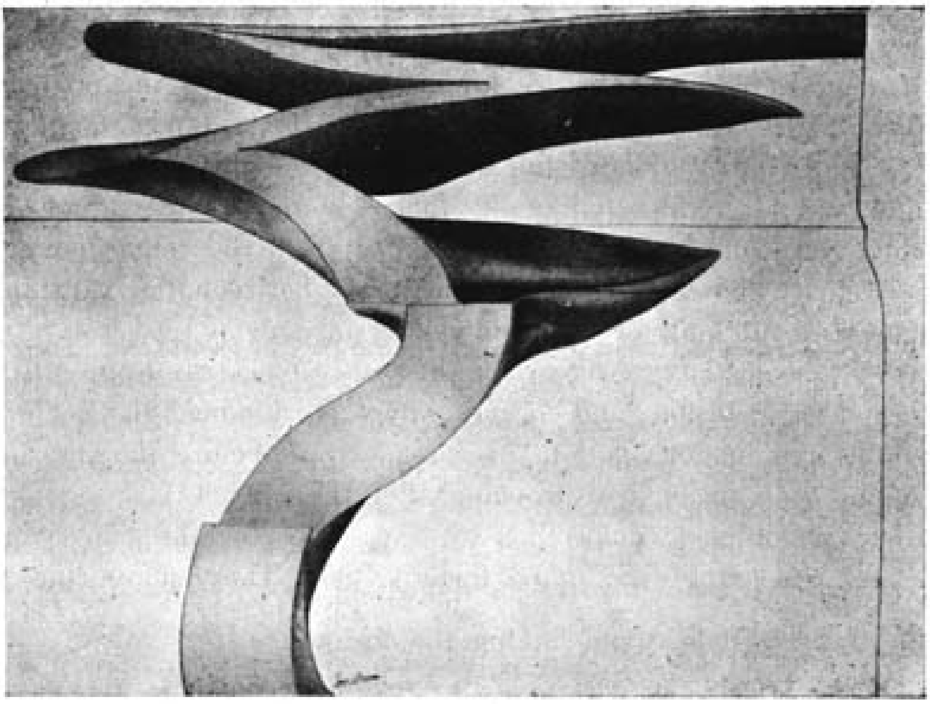
[1]) This quotation has been translated from the Dutch of Dr. Lorié by me.

Fig. I.



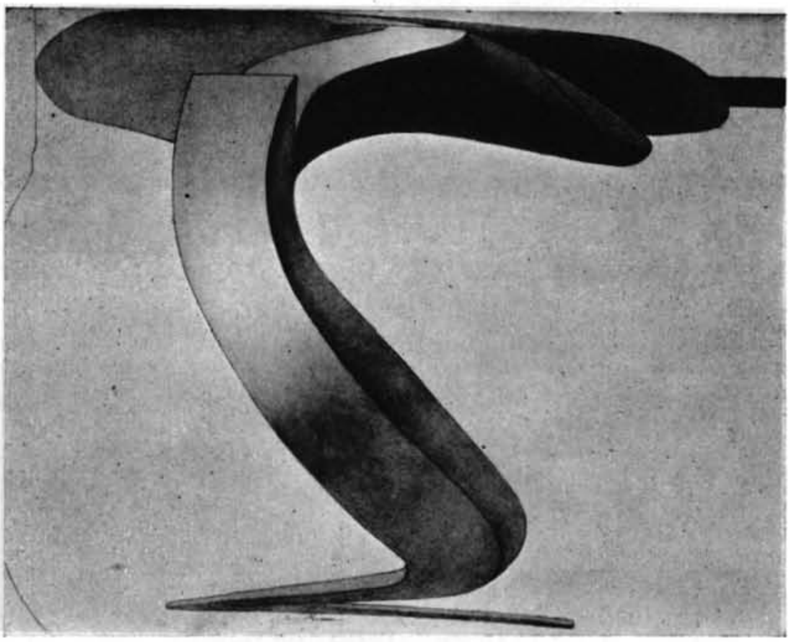
Trunkmyotome of Petromyzon fluviatiles. Enlargement 2 times.

Fig. IV.



Trunkmyotome of Acanthias; dorsal and lateral part in natural size.

Fig. V.



Trunkmyotome of Acanthias; ventral part in natural size.