here, too, the resistance increases with heating, decreases with exposure to light [1]).

In conjunction with Mr. VAS NUNES I hope shortly to publish also some quantitative data on the phenomenon discovered by me, and also on the behaviour of the melted and again solidified antimonite and the analogous selenium compound. This investigation has been made in the Physical Laboratory at Amsterdam.

Anatomy. — *"On the influence of the fins upon the form of the trunk-myotome"*. By B. VAN TRICHT. (Communicated by Prof. G. C. J. VOSMAER). (From the Anatomical Institute at Leyden).

(Communicated in the meeting of March 30, 1907).

This research forms a direct sequel to Professor LANGELAAN's work "On the Form of the Trunk-myotome", and is intended to show the influence of the fins upon the form of the myotome. The method which I followed, was based upon the chief result of the foregoing research viz. that the differentiation of the myotome takes place in a continuous manner by means of folding, and that it is possible to follow the process of folding in dissecting the intermyotomal tissue. Now the method of direct dissection proved to be restricted in its application, so that it was necessary partly to apply a more indirect one. This latter method rests upon the relation, which exists between the form of the myotome and the structure of the transverse sections of the animal.

Differentiation of the dorsal musculature.

From a rather large sample of Mustelus vulgaris the skin with the underlying connective tissue was removed, so that the external surface of the myotoms was laid bare (figure I). Then in the region before the first dorsal fin the parts constituting one and the same myotome were determined; the form of this myotome exhibited about the same form as in Acanthias, only the lateral part of the myotome proved to be displaced caudally; the breadth of this displacement amounted to about half the breadth of the myotome. This myotome was arbitrarily indicated by the number

[1]) I have made an arrangement with Mr. J. W. GILTAY at Delft with regard to the mounting of antimonite preparations, and the preparation of antimonite cells for practical use.

1 and the following myotoms by subsequent numbers. After that, transverse sections of the animal were made, of 1—2 cm. thickness, and the numbering transferred to these sections, so that the lamellae belonging to one and the same myotome received the same number. For the sake of an easy description, figure II gives a hemischematic representation of the myotome, in which the peaks are indicated by numbers, the lamellae by letters. In figure III which is the transverse section, (indicated in figure I with an *A*) the peaks appear as systems of concentric lamellae marked in accordance with the marking in figure II. If we now pass to the region of the first dorsal fin (figure IV, section *B* of figure I and fig. V, section *C* of fig. I) the image of the transverse section is changed, instead of being composed by four peaks, the dorsal musculature only shows three peaks.

The peak, indicated as number 1, has disappeared and instead of this peak we find the first lamellae of the dorsal fin. Now in all subsequent sections this first peak does not reappear any more. By the method of successsive numbering it was possible to determine the first myotome losing its most dorsal peak (number 1). The external surface of this myotome is blackened in figure I. From the principle laid down in the beginning of this notice ensues, that the myotome apparently losing its first peak, gives a muscular element to the dorsal fin; this element is therefore also blackened in figure I. It may be seen in figure I that the first myotome giving an element to the fin lies a little caudally in respect to the front edge of this fin. The number of myotomes giving a part to the first dorsal fin may easily be determined, because these composing parts of the fin are separated by intersegmental tissue; that we have really to deal with intersegmental tissue follows from the fact that through these lamellae bloodvessels and extremely fine nerve fibres reach the skin (vid. v. Bisselick "On the Innervation of the Trunk-myotome"). The total number of muscular elements composing the fin, amounted to 34, so that the last myotome still giving an element to the first dorsal fin already lies in the region of the second dorsal fin. From the fact that the most dorsal peak (number 1) does not reappear any more in the transverse sections, it follows that the next myotome gives the first element to the second dorsal fin. The surface of this myotome is also blackened in figure I to show its position in relation to the front edge of the second dorsal fin. It is evident, that this myotome occupies the same position in respect to the second dorsal fin as the first myotome does in respect to the first dorsal fin. The number of myotomes composing the second dorsal fin amounts to 30.

Upon the second dorsal fin follows the dorsal part of the caudal

fin. In this fin the myotomes are pressed together so closely that a direct counting of the number composing the fin is no more possible; by comparing the total number of vertebrae to the number of myotomes composing the first and second dorsal fins, we find that about 70 myotomes give an element to the dorsal part of the caudal fin.

The results obtained by this indirect method are corroborated by the result of the direct dissection. If we take a myotome giving a muscular element upon the more anterior part of the dorsal fin and begin the dissection with lamella *b* in the neighbourhood of the second peak and proceed preparing caudally, we find lamella *b* being rolled in, towards the mesial plane of the body, in the shallow excavation in which the base of the fin rests, (fig. VI). Along this way the muscular tissue becomes gradually atrophic and only a thin band remains, consisting of the connective tissue which forms the framework for the muscle fibres. In the neighbourhood of the sagittal plane of the body this lamella is folded, in such a manner, that the line of folding (figure VI L'' L'') runs parallel to the sagittal axis of the body. By this process of infolding the direction of the lamella *b* is reversed, the infolded part proceeding cranially; this part of lamella *b* passes into the dense sheath of connective tissue, which is interposed between the dorsal musculature and the base of the fin. As far as I can see this sheath of connective tissue is chiefly built up by a large number of these lamellae, but they are so inextricably united that I have not been able to follow lamella *b* in this sheath. If starting from the fin, we prepare free one muscular element of the fin, and this element is lifted up with enough precaution, it may be seen, that from the base of such a fin-element as well a thin lamella of connective tissue passes into that sheath of tissue in which we could follow the reversed part of lamella *b*. The direct continuity however of both lamellae in the sheath of dense connective tissue, I have not been able to establish.

The muscular elements composing the fin (figure VI) are triangular laminae; one side of the triangle is contiguous to the fin-rays and the connective tissue which unites these rays in the mesial plane of the body, the lateral side forms part of the lateral surface of the fin, while the base is excavated and moulded upon the shallow depression in the dorsal musculature. From the outside a septum of intermyotomal tissue (s. i. figure VI) penetrates into the muscular substance of the fin dividing this substance into a lateral (*b*) and a mesial part (*a*). This septum inserts a little above the muscular substance upon the fin-rays, and becomes thinner and thinner without

reaching the base of the fin. At the base therefore the lateral and mesial parts of the muscular substance are continuous and form a peak (figure VI p. 1), lying quite near the mesial septum of the body. This peak must therefore represent the peak which is lost in the transverse section (figure IV) made at the level of the first dorsal fin. The septum penetrating into the muscular substance of the fin is therefore the intermyotomal septum stretched out between lamellae *a* and *b* of figure II.

It ensues therefore from the combined observations, that the first dorsal fin (and the same applies to the other dorsal fins) is differentiated by a process of infolding similar to the differentiation between the dorsal and the lateral and between the lateral and the ventral musculature. The line of infolding crosses lamella *b*. In that part of the lamella, which lies in the depth of the fold the muscular tissue is atrophic. Proceeding from peak 2 caudally along lamella *b* the atrophy of the musclefibres gradually increases, whilst on the other hand proceeding from peak 1 caudally along lamella *b* (as far as it lies upon the fin) the atrophy of the muscular tissue is abrupt. The position of peak 1 has not changed in respect to the mesial plane of the body, only the lamellae have changed their direction. The superior cornu (i. e. lamella *a*) is no longer directed cranially but turned upwards and this is also the case with that part of lamella *b* that has passed into the fin. In connection with this representation of the facts, I determined the direction of the muscle fibres in the fin; here they slope downwards from the intermyotomal septum. Now if we imagine the lamellae composing the fin restored to their original position, the course of the fibres in lamella *a* would be from mesial to lateral and from caudal to cranial and this was actually the direction of the muscle fibres in lamella *a* in the region cranially of the first dorsal fin.

Differentiation of the latero-ventral musculature.

The lateral musculature, as described by VAN BISSELICK, shows a peak directed caudally (peak 5, figure II and fig. VII) situated near the second line of infolding L'L'. Proceeding along the body a second peak appears directed cranially. The first myotome showing this peak (peak 6, fig. II and fig. VII), is the eleventh myotome following the first myotome giving a muscular element to the first dorsal fin. The two peaks lie near to each other in the neighbourhood of the second fold. In consequence of the infolding of the myotome at that place, they do not reach the surface of the body, being covered from the outside by the ventral musculature. Meanwhile the ventral part of the myotome undergoes a change in form, the first lamella belonging

to the ventral musculature (lam. *f* figure II and fig. VII) becomes shorter and the first peak of the ventral musculature directed cranially (peak 7, figure II), more and more develops into a true peak. Now by the disappearence of lamella *f* peak 6 and 7 approach each other, remaining divided, however, by a thin lamella of connective tissue penetrating into the second fold along the line L'L' (fig. VIII and IX). In consequence of the process of infolding peak 6 lies mesially in respect to peak 7 which covers peak 6 from the outside. At the level of myotome 15 (reckoned from the first myotome, giving an muscular element to the first dorsal fin) the second fold vanishes. Together with the disappearence of the fold we notice the vanishing of the displacement of the lateral musculature in respect to the ventral musculature, which was only a consequence of the process of infolding, so that the two peaks (6 and 7) lie side by side in the same transversal level of the body. At the place of disappearance of the second fold the two peaks unite to a single peak directed cranially. Together with the disappearance of lamella *f* we notice the further development of lamella *g*.

At the same level where the second lateral fold disappears, we find the appearance of the cartilagineous plate, uniting the two basipterygii of the pelvic fins. With its front border, this plate folds in lamella *g* (figure II and X) from the inside so that this lamella covers the front edge of this plate; in this way the pelvic fin is formed. The details of the formation of the pelvic fins I have not yet investigated. By the formation of the pelvic fin peak 8 (fig. II) and lamellae *g* and *h* pass into the musculature of the fin, so that in a transverse section through the animal, at the level of the pelvic fin, the trunkmusculature is only composed by five peaks (viz. 2. 3. 4. 5. (6 + 7) of figure II). This structure of the transverse sections does not change any more proceeding along the body caudally (figure XI and XII).

The disappearance of the first fold, dividing the dorsal from the lateral musculature, takes place in the same way as described for the second fold, at the level of myotome 45 (reckoned from the first myotome giving an element to the first dorsal fin); only the case is more simple not being complicated by the presence of two peaks.

Finally I paid attention to the influence of the abdominal cavity upon the form of the myotome. I found this influence to be very restricted, as it only determines to some extent the dimensions of the myotome, without producing any particular differentiation in its form.

In fine I wish to express my thank to Prof. LANGELAAN for his aid and assistance in these researches.

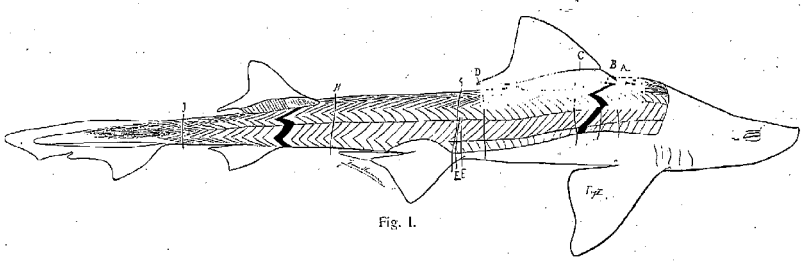

Fig. I.

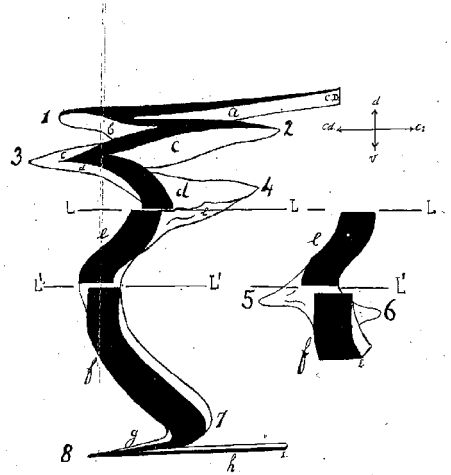

Fig. II.

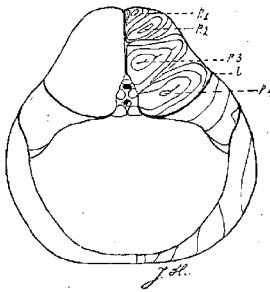

Fig. III.

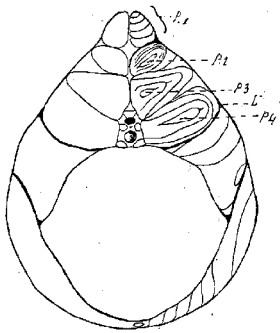

Fig. IV.

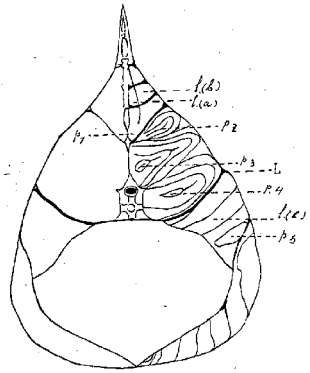

Fig. V.

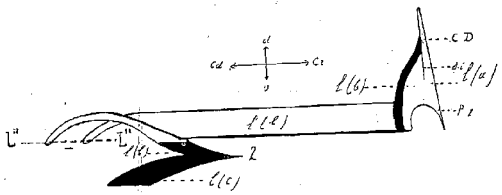

Fig. VI.

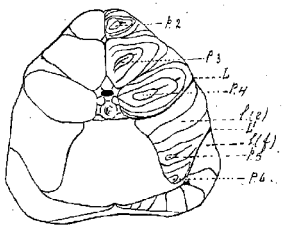

Fig. VII.

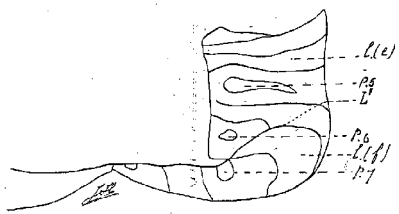

Fig. VIII.

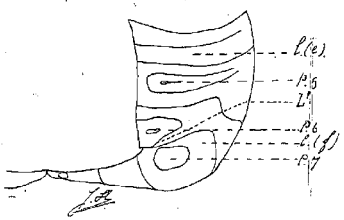

Fig. IX.

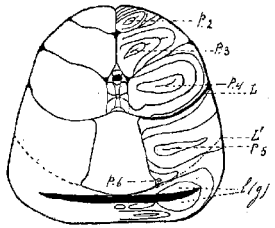

Fig. X.

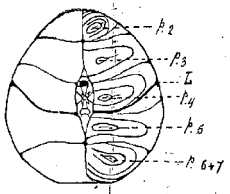

Fig. XI.

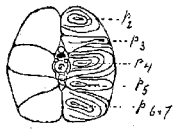

Fig. XII.