

THE METAMERISM OF THE DORSAL AND THE VENTRAL LONGITUDINAL MUSCLES OF THE TELEOSTS.

By ROSS GRANVILLE HARRISON.

Under this head are to be considered, the mm. *supra-carinales*; the *infra-carinales* including the *retractor ischii*; the *rectus abdominis*, and the *coraco-hyoideus*. These muscles are all slender bands of longitudinal fibres, are paired in origin, and generally lie close to the mid line, in the case of the *supra-carinales* at the dorsal edge of the lateral body muscles or myotomes, and in the case of the others at the ventral edge. Of the dorsal muscles there are two; one extends from the occipital to the first ray-support of the dorsal fin; the other, from the posterior ray-support of this fin to the tail. The analogous muscles of the ventral side connect the hard parts of the extremities in a similar way. An *infra-carinal* extends from the anal fin to the tail; a similar muscle originates from the posterior portion of the pelvis, and running posteriorly, encircles the anus, and is attached to the first ray-support of the anal fin; this muscle has been called the *retractor ischii*. The anterior end of the pelvic bone is connected with the shoulder girdle by a similar muscle. This naturally varies according as the position of the ventral fin varies with respect to the pectoral. It varies also in the degree of its independence from the lateral body muscles. In the salmon it is a quite independent band of muscle fibres, and its position in the adult and its mode of development justify us in homologizing it with the *rectus abdominis profundus* of the amphibia. [See Maurer, *Der Aufbau und die Entwicklung der ventralen Rumpfmuskulatur bei den Urodelen Amphibien. Morph. Jahrb.*, Bd. 18.] Anterior to the shoulder girdle, this muscle is continued forwards as the *coraco-hyoideus*, which is attached to the base of the hyoid arch.

These facts regarding the myology of the adult teleosts have long been known. The points which I am here able to contribute to our knowledge of their development in the salmon may not prove uninteresting.

Excepting the *coraco-hyoideus*,* the anterior of the *supra-carinales* is the first to make its appearance. In the region of the anterior myotomes of embryos in the dorsal fins of which muscle buds have just appeared, there arise aggregations of mesoderm cells, one on each side of the mid line, dorsal and median to the dorsal edge of the lateral muscles. The cells which make up these masses are of doubtful origin; they may wander there

* The development of this muscle is described in my paper on the fins.

singly from the dorsal edge of the myotomes, where the cells are still undifferentiated, or they may be mesenchyme cells which have collected at these points. At first no traces of segmentation are present. These cell aggregations extend slowly backwards until they nearly reach the dorsal fin, and finally they become attached to its anterior ray-support by means of a tendon of some length. Long before these loose strands of cells have reached the dorsal fin, the anterior ones begin to differentiate into muscle-cells. Segmentation now arises in the young muscle, which becomes divided into a series of small segments connected by tendons. This segmentation arises independently of the metamerism of the body and bears no constant relation to it; the segments are from one and a half times to twice as long as the myotomes. Those of the two sides do not correspond with one another but show a tendency to alternation.

Just after the completion of the anterior muscle the posterior makes its appearance in a similar way and develops in like manner except that it is formed almost simultaneously throughout its entire length. The ventral muscles or *infra-carinales* also arise similarly except that the cells giving rise to them show at first an undoubted connection with the ventral edge of the myotomes. These muscles are all segmented in a manner similar to the dorsal ones.

The development of the *rectus abdominis* differs in important details from that of the other ventral muscles, although, like them, it arises from the undifferentiated ventral edge of the myotomes. In young salmon in which the anterior supra-carinal muscle has reached the dorsal fin, but which still possess a large yolk, the myotomes posterior to the pectoral fin have grown in the body wall, out over the yolk-sac for some distance, forming a rather thin lamina of muscle (*ventraler Urvirbelfortsatz* of Maurer). The intermuscular septa run obliquely forwards and ventrally. The periphery of this muscle lamella is composed of a band of undifferentiated cells.

Beginning with the myotome just in front of the anterior end of the definitive pelvis, this band of cells soon separates from the myotomes. This separation, gradually extending forwards, there arises a strand of undifferentiated cells which is independent of the lateral muscles. A good while before the anterior portion of this embryonic muscle has acquired its independence, the posterior portion begins to differentiate into muscle fibres, and like the other muscles becomes segmented, but not correspondingly with the metamerism of the body. The anterior portion also differentiates into muscle cells, and not yet having lost its connection with the processes from the myotomes, septa are formed here at corresponding points, and, unlike the posterior portion of the muscle, the anterior portion corresponds in its metamerism with the rest of the body. The factor which renders this difference in the two portions of one and the same muscle possible is that, while in general all differentiations appear first in the anterior metameres and extend gradually backwards, this muscle becomes independent at its posterior end first; its tissue, however, differentiates in accordance with the general law and the consequence is, that when differentiation begins, conditions not being alike throughout the whole extent of the muscle, a difference arises in the metamerism of the two parts.

In conclusion then, it is seen that certain muscles, although segmented, have acquired their segmentation independently of the general metamerism of the body, and that even the same muscle may in different portions exhibit different relations between its own segmentation and that of the myotomes. The segmentation of muscles, as observed in the adult, therefore, may or may not have been secondarily acquired, and in view of this, it would seem that observations on the adult anatomy alone are not to be relied upon for determining the number of myotomes which originally took part in the formation of the muscle.
