THE INTERACTION BETWEEN NERVE AND MUSCLE DURING METAMORPHOSIS OF THE WAXMOTH *GALLERIA MELLONELLA*

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BY CLARE WARD

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ABSTRACT

This thesis is concerned with the interaction between the nervous system and muscles during the metamorphosis of the waxmoth *Galleria mellonella*.

The mesothoracic dorsolongitudinal muscles of the waxmoth arise from dorsal muscles in the larval mesothorax. Several of these dorsal larval muscles begin their transformation shortly before the larva-pupa ecdysis when they break down to be replaced by presumptive myoblasts. These appear to arise from the nuclei of the larval muscle. In the 60-72 hours pupa all three mesothoracic dorsolongitudinal (2dl) muscles are made up of the characteristic number of fibres and the first dorsolongtudinal muscle (dl1) has its characteristic adult shape. From the 82 hour stage onwards the muscle fibres increase in diameter until the 168 hour stage when the muscles have achieved the adult condition.

Cautery of the first thoracic ganglion of the larva or section of the nerve cord between the first two thoracic ganglia leads to an adult in which most of the 2dl muscles are absent. Only the dorsal part of 2dl1 is present as normal.

Up until the 24 hours pupa cautery of the first thoracic ganglion has the same results as cautery of the larva. Cautery of the 25-30 hours pupa results in an adult in which the ventral fasciculae of 2dl1 are represented by a few tiny muscle fibres. At this stage there is no sign of 2dl2 or 2dl3 except for a few small cells which are about the same size as presumptive myoblasts.Cautery of the 40 hours pupa leads to an adult in which all of the 2dl1 fasciculae are present as smaller versions of the normal case.Up until the 108 hours pupa cautery of the first thoracic ganglion leads to an adult in which the 2dl1 muscles

are smaller than normal.

An ultrastructural investigation of the small cells found in the denervated adult in the place of the 2d1 muscles showed these to be similar to presumptive myoblasts. It therefore appears that the nervous system affects the ability of the presumptive myoblasts both to differentiate and then to grow as normal.

Denervation of the fifth and sixth instar larvae by section of one of the connectives between the first two thoracic ganglia has the same effect on the operated side as denervation of the last larval instar. Cobalt staining of the nerve supplying the dorsal muscles of the larva shows that the motor neuron complement in both the fifth and seventh instar larvae is very similar. Cobalt staining of the nerve to the 2d1 muscles of the adult reveals cell bodies which are similar in position and size to those found in the larva.

The interaction between nerve and muscle during development in insects and vertebrates is discussed. From this work it is hypothesised that the nervous system affects muscle development by preventing mitosis in the presumptive myoblasts. It is also hypothesised that the adult muscles are served by the same motor neurons which were present in the later instars of the larva.

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