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A NOTE ON THE PALING CENTRE OF THE MINNOW (*PHOXINUS PHOXINUS* L.)*

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INTRODUCTION

Von Frisch (1911), from a series of cutting experiments on the brain and from brain stimulation, concluded that there was a 'Aufhellungszentrum' situated in the medulla of the minnow which caused the fish to pale. More recent work by Gentle (1971*a*, *b*, *c*) has shown that the optic tectum is necessary for colour change to occur and considerable paling can be produced in a darkened bilaterally blinded fish by a single lesion in the optic tectum. The work described here was a degeneration study performed to trace the fibres destroyed by this lesion.

MATERIALS AND METHODS

Ten normal minnows were taken and a lesion was placed in the left lobe of the optic tectum in position $X_0\,Y_1$ mm as described in a previous paper (Gentle, 1971*a*). After cementing over the skull (Simplex Acrylic, Dental Fillings Ltd., London) the fish were placed in experimental aquaria. They were kept at 18 °C, and two fish were removed on the 10th, 16th, 19th and 21st day after the lesion. The fish were killed by decapitation and the heads were fixed in 10% formol-saline for a period of 5 weeks. The brains were dissected out, embedded in paraffin wax, and cut transversely and longitudinally at 8 μm for each survival time. They were stained using the paraffin modification of the Nauta technique (Guillery, Shirra & Webster, 1961), and in many cases counter-stained using cresyl fast violet. The optimum survival time for the degeneration of the tectal efferents was found to be 16 days.

RESULTS

Considerable degeneration was seen to occur in both the stratum plexiforme et fibrosum externum and the stratum fibrosum profundum throughout the tectum. A distinct bundle of fibres was observed to run out of the tectum laterally and then ventrally through the torus semicircularis to become part of the tractus tecto-bulbaris ventralis rectus (Kappers, Huber & Crosby, 1936). Isolated fibres were also found running to the hypothalamus and to the ganglion isthmi. These isolated fibres were very few and the majority were seen in the bundle of the tractus tecto-bulbaris ventralis rectus.

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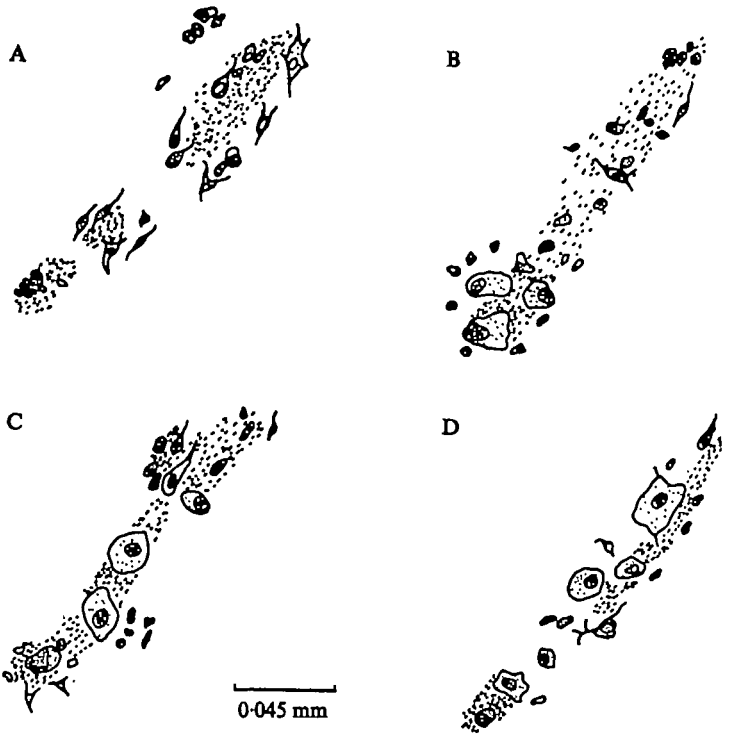

Fig. 1. A series of drawings through the medullary centre to show the cells and the distribution of the degeneration droplets. A is the most lateral. B is 32 μm medial to A. C is 32 μm medial to B. D is 16 μm medial to C and no structures were visible 16 μm medial to D.

The degenerating fibre bundle of the tractus tecto-bulbaris ventralis rectus appeared to course caudally with the rest of the tecto-bulbar tract until it reached a point at the anterior end of the medulla. A few fibres did not end here but continued through the medulla and were seen in the spinal cord constituting part of the tractus tecto-spinalis. Some of the fibres ended in the medulla, where they could not be seen to enter any definite neurone group. The majority of degenerating fibres ended in a small group of neurones. This small group of neurones contained both large and small cells, approximately 14 large and 100 small. The neurone group is shown in a series of drawings (Fig. 1). Both the large and small neurones were arranged along the entire length of the group and there did not appear to be any definite organization. The approximate position of the group of neurones was 1·4 mm from the apex of the cerebellum caudally, 2·75 mm ventrally from the upper surface of the cerebellum and 1 mm from the midline in a fish 6·5 cm long. These values were calculated from the sections of the brain and have not been corrected for shrinkage.

Although these degenerating fibres and associated group of neurones were found it is not certain that the latter constitute the medullary paling centre. Further experiments need to be carried out to see what function if any these neurones have in the control of colour change.

SUMMARY

1. The degeneration of the tectal efferent fibres was studied using the paraffin Nauta technique following lesion to the optic tectum in *Phoxinus phoxinus* L.

2. A degenerating fibre bundle of the tractus tecto-bulbaris ventralis rectus was found to end in a group of neurones in the anterior medulla.

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