A Functional Relationship between Neurosecretory Fibres and Pituicytes in the Eel

SYNAPTIC contacts between neurosecretory fibres and pituicytes have been demonstrated in the eel, and the suggestion made that this association might form part of a mechanism for feed-back of information to the hypothalamus[1]. Recent experimental investigations support this view.

Fifty eels were kept in darkness for 3–5 weeks and then transferred to illuminated white or black backgrounds for 4 h. The pituitaries of the white background animals showed the following features in contrast to those of eels kept on a black background:

(1) Many synapses between neurosecretory fibres (with elementary neurosecretory vesicles of 1200 Å diameter) and pituicytes.

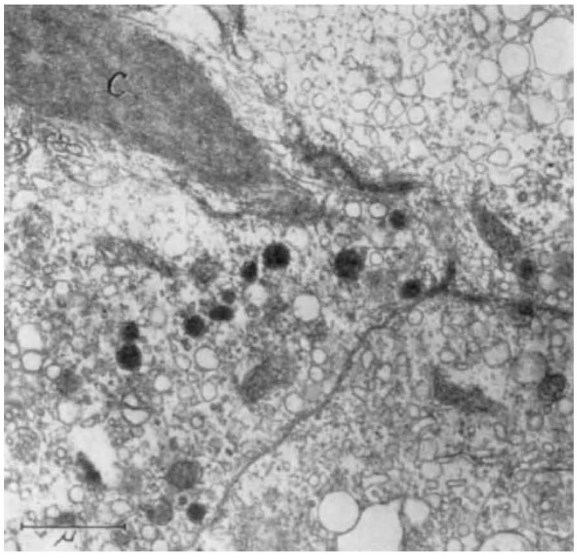

Fig. 1. An electron micrograph showing part of a group of pituicytes in the pituitary of an eel maintained on an illuminated white background. Membrane-bound secretory inclusions may be seen. *C*, Colloid

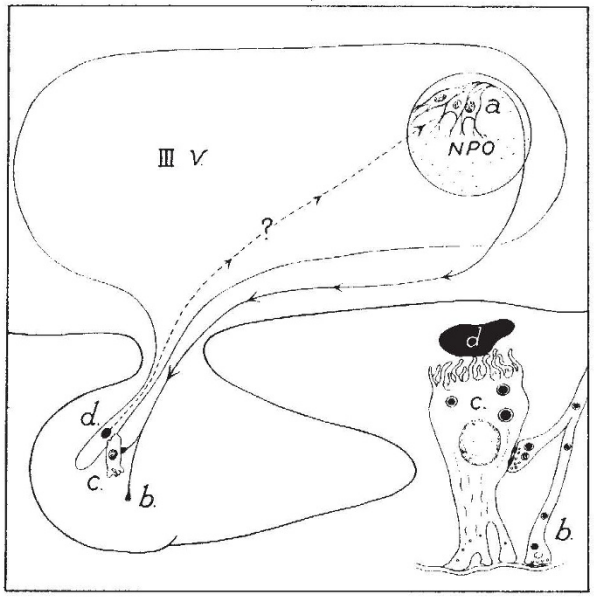

Fig. 2. A diagram depicting a possible feed-back mechanism linking the proximal and distal parts of the hypothalamic-hypophysial neurosecretory system of the eel. *a*, Preoptic nucleus (*NPO*); *b*, synapse; *c*, pituicyte: *d*, periodic acid-Schiff-positive colloid. III V, third ventricle of brain

(2) A great number of membrane-bound secretory droplets, about 4000 Å in diameter, in the pituicytes.

(3) Much periodic acid–Schiff-positive material in the central canals (Fig. 1), surrounded by pituicytes; these canals appear to be in communication with the ventricles of the brain.

All these features were rare in control animals and black background animals.

These observations are consistent with a view that in the eel neurosecretory fibres may stimulate pituicytes to release their products into the cerebrospinal fluid. By so doing they might affect the preoptic nuclei since it has been shown that dendrites of the perikarya of the neurosecretory neurones project into the ventricles of the brain in the eel[2], frog[3] and toad[4].

An association of neurosecretory fibres and ependymal cells has been demonstrated in a bird[5], and recently it has been shown that ependymal cells in the median eminence of the rat appear to have a glandular function and secrete into the cerebrospinal fluid, though no synaptic contacts between these cells and nerve fibres were observed[6].

The cerebrospinal fluid could act as a means of transport between the pituitary and the hypothalamic nuclei and thus provide a channel for the transfer of information from the distal to the proximal part of this neurosecretory system. The work recorded here suggests a possibility that pituicytes or other glial elements might play an important part in such a process.

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A Dual Neurosecretory Innervation of the Pars Distalis of the Pituitary of the Eel

INVESTIGATIONS of the innervation of the eel pituitary with the light microscope demonstrated in the pars distalis a few nerve fibres which stained with the Gomori technique and many others which did not[1]. The latter, which appeared to originate in the nucleus lateralis tuberis, do not seem to stain with any of the common 'neurosecretory' stains[2], and therefore under the light microscope the degree of neurosecretory control of the pars distalis appears to be slight.

Under the electron microscope, however, an extensive neurosecretory innervation of the pars distalis can be demonstrated. Most of the fibres which invade the anterior lobes of the pituitary (proximal and rostral pars distalis) are seen to contain vesicles, irregular in outline, each with a central electron-dense granule about 700 Å in diameter. These fibres are found also, with their perikarya, in the nucleus lateralis tuberis; they resemble the Type *B* neurosecretory fibres described in the neurointermediate lobe of the elasmobranch pituitary[3]. They do not stain with neurosecretory stains, but nevertheless should be termed neurosecretory[4]; they discharge into perivascular and intervascular spaces which permeate the pars distalis.

Material with affinity for neurosecretory stains appears in abundance only in mature eels in which there is evidence of an increased activity of GTH and TSH cells[2]. In these animals many typical neurosecretory fibres containing Type *A* elementary neurosecretory vesicles[3], about 1400 Å in diameter, are found. These fibres were extremely rare in elvers or young eels.