Kintyre⁶ while from the Island of Barra in the Outer Hebrides a single specimen in the drift⁶ and one or two dredged specimens³ have been recorded.

While making a survey of the inter-tidal algae of Barra in July 1961, particular attention was paid to the presence of *Cystoseira*, and near Cliad on the west coast of the Island an abundant growth of *Cystoseira tamariscifolia* was found. The plants were growing in deep tidal pools at a level near mean low water of spring tides and were associated mainly with *Codium fragile* subsp. *atlanticum* and *Halidrys siliquosa*. They ranged from 10 to 25 cm. in height, formed bush-like tufts in the water and showed the marked iridescence normally associated with this species. Several days later, following a severe gale, large quantities of *Cystoseira tamariscifolia* were found in the drift at many localities on the west coast of the Island, suggesting that an abundant growth may occur at sub-littoral levels.

In view of the range in size and the numerous receptacles found on the plants it is likely that this species is vigorously multiplying and that it is present on other Hebridean Islands. This latter suggestion is supported by the finding of fresh drift specimens of this alga on the west coast of Rhum⁷ in August 1961. Any further records of *Cystoseira tamariscifolia* from Scotland will be welcomed.

I thank Dr. Helen Blackler of the British Phycological Society's Check-list Committee for confirming my identification of the species.

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An Annelid Proprioceptor

THE structure of the worm *Harmothoe* is in most respects typical of errant polychaetes; it has well-developed parapodia armed with bristles and provided with dorsal and ventral cirri, but on the dorsal side of the worm are scales (elytra) which most polychaetes do not have. Methylene blue preparations reveal the following types of sense organs: (a) numerous small bipolar cells of ventral cirri and of the elytra; (b) a group of bipolar cell bodies with branched endings in the region where the bristles emerge from the parapodial cuticle; (c) numerous and scattered bipolar cells beneath the cuticle particularly on the ventral side of the body; (d) bipolar cells of the elytra; (e) concentrated groups of bipolar cells standing at right-angles to the surface in the thickness of the epithelium; (f) several bipolar cells each with a long dendrite stretched diagonally across the ventral side of every parapodium. Types (a), (c) and (e) are described by Smith¹.

No other type of peripheral neurone is found and each of the peripheral sensory cells appears to send an axon the whole way to the central nervous system. There is no trace of a peripheral nerve net or running together of axons.

Recording externally from the sensory axons reveals that types (b), (c) and (f) include mechanoreceptors. Types (a), (d) and (e) have not been investigated because of technical difficulties in re-

Fig. 1. Bipolar proprioceptor cells (p) lying in the cuticle across the ventral side of two adjacent parapodia of *Harmothoe*. Some of the axons of the parapodial nerve (II) are also shown. Anterior is at the top. Scale, 1 mm.

cording their responses. The group (b) are sensitive to any touch of the bristles and respond with an adapting discharge. Of the type (c) cells scattered over the body, many, and perhaps all, respond to touch or strain of the cuticle. Most notable of all, large bipolar cells (f) respond to strain of the cuticle of the base of the parapodium and hence to any parapodial movement, passive or active. They are therefore proprioceptors. Their responses are readily recorded as large spikes after eliminating the bristle responses by pulling out the bristles. A mechanical deformation of 100 μ can be applied by a small stylus on the region occupied by the dendrite of the bipolar cell shown in Fig. 1. A maintained sudden stretch of the dendrite causes a discharge of impulses in the axon of the long bipolar cell, with adaptation over the course of a few seconds. The impulses are thus identified with the (e) neurones. The size and regular arrangement of the latter in every segment also suggest their function as proprioceptors.

A proprioceptor which adapts so quickly can scarcely be effective in co-ordination of the initial direction of the movement when a resting animal begins to move. One can readily observe how a worm modifies its parapodial posture to suit the irregularities of the substrate, but no evidence has ever been produced to suggest that the basic sequence of locomotory movement is co-ordinated by proprioceptors in polychaetes. It has been found that injection of liquid paraffin into the parapodial cavity, or local cuts in the area of the proprioceptors, alter neither the fundamental sequence of movement of the operated parapodium, nor its relationships with the movements of neighbouring segments. The conclusion is therefore that the main sequence of movements is centrally controlled, though it can be appropriately modified in detail by mechanoreceptors of the body wall including proprioceptors of the parapodia.

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