There was no significant change in any of these parameters in the three control fish studied. GFR remained high after chromate; indeed there was a small, but significant increase in GFR by period IV compared to period II. Urine volume increased progressively after chromate.

Eighteen hours after chromate infusion (lower half of Table) fractional urea reabsorption remained significantly depressed compared to that of control dogfish kept in the same tank and studied at the same 18-hour interval. Fractional sodium reabsorption was also depressed but to a lesser extent and the ratio of urea to sodium reabsorption in the chromate-treated fish was again significantly below that of the controls ($p < 0.05$). Urine volumes were comparable but GFR in the experimental fish was below that of the controls.

These findings indicate that chromate is a potent and long-lasting inhibitor of urea reabsorption in the dogfish kidney and that its effect is to some degree selective in relation to its effect on sodium reabsorption.
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1974 #13

ELECTRON MICROSCOPY AND ELECTROPHYSIOLOGY OF THE GIANT AXON OF *Myxicola infundibulum*

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Electron microscopic and electrophysiologic studies of the giant axon of *Myxicola infundibulum*, a marine annelida, were conducted as a preliminary step in the development of techniques to examine transport systems in nerve

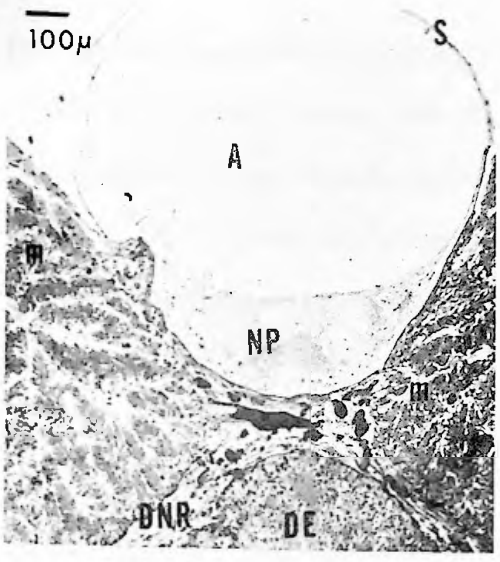

Figure 1: Photomicrograph of a cross section the *Myxicola* giant axon stained in Toluidine blue.

Figure 2: Electron micrograph showing the channels in the Schwann cell layer (SC) which frequently anastomose with each other, (arrowheads).

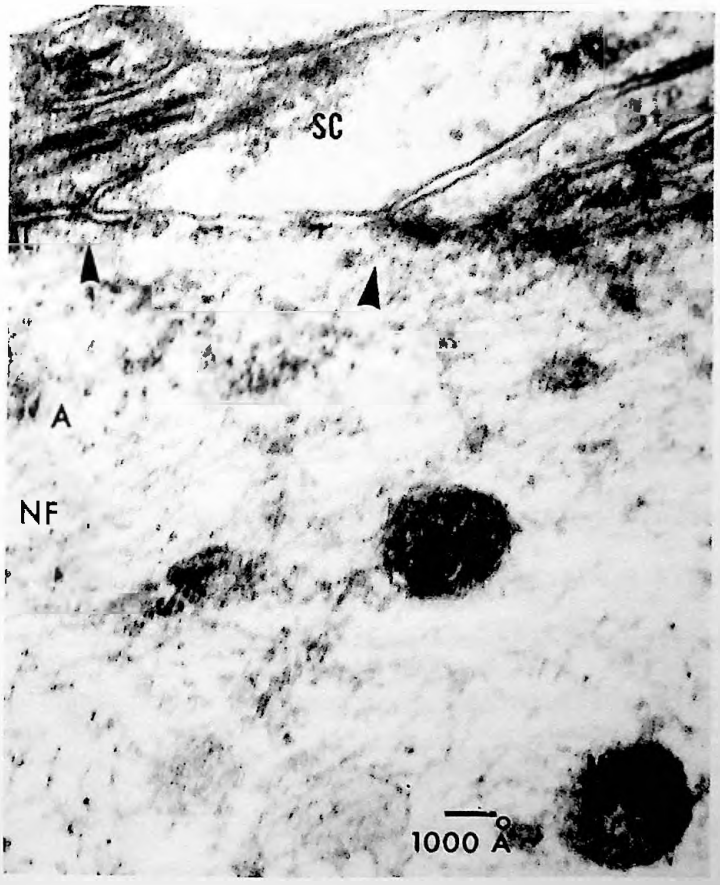

Figure 3: Electron micrograph showing the communication (arrowheads) between the meshwork of channels in the Schwann cell layer (SC), and the channel which surrounds the axolemma (AL). Note the presence of mitochondria (M) and neurofilaments (NF) in the axoplasm (A).

membranes. The *Myxicola* were obtained from Marine Research Associates, Lords Cove, Deer Island, New Brunswick, Canada, and weighed 3.5 - 5.0 grams. The giant axon was removed by dissecting through the dorsal epithelium in a bathing solution of 10 percent ethanol in cold sea water. For electron microscopic studies, cross sections of the axon were fixed in 3 percent glutaraldehyde in artificial sea water (Instant Ocean), post-fixed in 1 percent osmium tetroxide, and processed according to the method of Walker and Schrodt (Anat. Rec., 178: 63, 1974). Electrophysiological data were obtained utilizing conventional glass microelectrode techniques. Resting membrane and action potentials were recorded photographically from a Tektronix oscilloscope.

In Figure 1 is shown a photomicrograph of a cross section of a giant axon, 930 microns in diameter, demonstrating the relationship between the axon sheath (S), axoplasm (A), and neuropile (NP). Also shown in this section are the dorsal root nerves (DRN) which pass between the lateral muscle bundles (m) and the dorsal epithelium (DE). The complex structure comprising the lateral and ventral aspects of the axon sheath is 16 microns thick and is composed of an external complex connective tissue layer and and inner Schwann cell layer 4 microns thick. The Schwann cell layer completely surrounds the axoplasm but is separated from it by an electron translucent channel 75 - 135 Å wide and the axolemma (Figure 3). The dorsal aspect of the axon sheath, between the axoplasm and the neuropile, contains only the Schwann cell layer and is 4 microns thick. The Schwann cell layer contains a meshwork of interconnecting channels, 92 - 193 Å wide (Figure 2), which are generally parallel to the axolemma and which connect directly to the channel surrounding the axolemma as shown in Figure 3. Villegas and Villegas also observed similar channels in the Squid giant

axon (J. Gen. Physiol., 43: 73, 1960), and suggested that these channels are a passive diffusion pathway for the movement of sodium and potassium ions and water across the Schwann cell to the axolemma. The axoplasm contains a few mitochondria and many neurofilaments. The neurofilaments are frequently interconnected by cross bridges and there are some long linear arrays of neurofilaments parallel to the axolemma.

The resting membrane potential was found to vary between -54 mV and -72 mV, with the inside negative with respect to the bathing solution, and the action potential amplitude to range from 70 mV to 104 mV with an overshoot ranging from +1 mV to +66 mV. These data and Strength-Duration curve plots were consistent with reported values for *Myxicola* (Binstock and Goldman, Science, 158: 1467, 1967) and other nerve membrane preparations (Moore, Holt, and Lindley, Biophysical J., 12: 157, 1972).

(Electron microscopy by Mrs. G. Currier is gratefully acknowledged.)

1974 #14

ION TRANSPORT AND PERMEABILITY STUDIES ON THE INTESTINE OF *Fundulus heteroclitus*

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Our previous studies of ionic flux across the intestinal mucosa have demonstrated that the electrical properties observed in fish intestine are different from those of mammalian intestine. For example in the intestine of marine winter flounder and freshwater catfish there was a net flux of Na and Cl ions from mucosal-to-serosal side, with the Cl ion predominant, resulting in a serosal negative potential difference (PD) (Huang and Chen,