

K-ATPase inhibition.

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AXONAL TRANSPORT OF PROTEINS IN ASYMMETRIC OPTIC NERVES OF FLATFISH

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During development, teleosts of the order Heterosomata acquire a laterally compressed shape and both eyes migrate, each to a different extent, onto the lateral (now dorsal) surface of the head. This differential migration of the eyes produces an asymmetry in the optic nerve so that one nerve is consistently longer than the other. The purpose of this study was to compare axonal transport of proteins in the optic system of these animals to determine whether rates of transport are related to or independent of length of axon.

Three species of flatfish were used; the yellowtail flounder, *Limanda*, and the winter flounder, *Pseudopleuronectes*, in which both eyes are on the right side and the right nerve is elongated, and the sand dab, *Scophthalmus*, in which the reverse is true.

Optic nerves and optic tracts were measured in 47 animals (Table I).

Table I

	Length of Nerve	Length of Tract	Total Length
Long Nerve	13.9 mm	5.4 mm	19.3 mm
Short Nerve	11.4 mm	5.2 mm	16.6 mm
% Difference	23%	3%	16%

Virtually the entire asymmetry is due to an elongation of the optic nerve. A sign test indicates no consistent difference in length of optic tract between the two sides. In all cases, the optic nerve and its associated tract could easily be separated from the opposite nerve and tract, indicating no mixing of fibers at the chiasm.

For transport studies, 10 Ci of ^3H -proline (specific activity 40 C/mM) was injected into each eye of an unanesthetized fish and after an interval of 3 hr. to 6 weeks, the animal was decapitated and the optic system fixed in situ in 5% paraformaldehyde in 0.2 M phosphate buffer, pH 7.2. The optic nerves, tracts and tecta were then dissected free, and immersed in cold 10% TCA for 24 hours. The nerves, tracts and tecta were then separated, weighed and measured, and the nerves were further cut into 3mm segments. The tissue was dissolved in Soluene-100 and counted in a toluene based scintillation fluid.

To estimate the transport rates, the mean radioactivity/mgm tissue from both tecta of all animals at each time point was plotted (Fig. 1). Two peaks occur, one at 18 hours after injection representing a rapid component traveling at 1-3 mm/hr., and one at 21 days, the slow component,

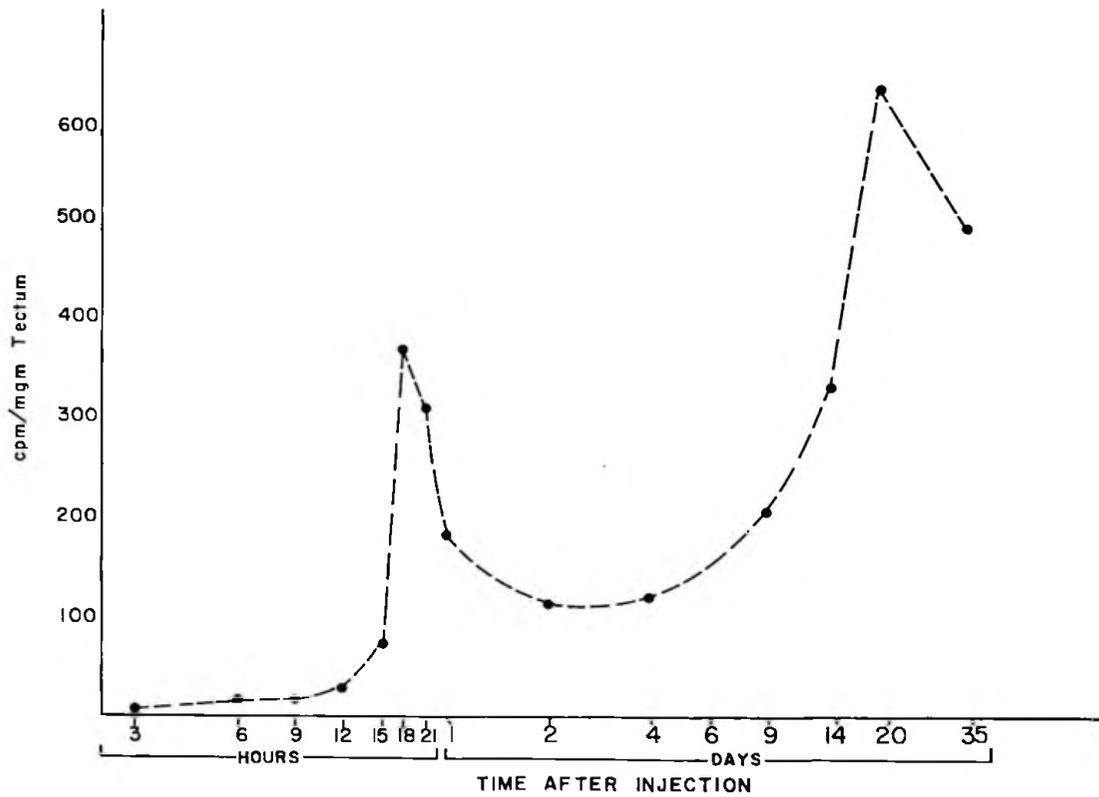


Figure 1

moving at 0.8 mm/day.

To determine whether the fast transported protein appeared in the tectum at the same time on each side or arrived later in the tectum connected to the longer nerve, the ratio of radioactivity in the tectum connected to the long nerve to the tectum connected to the short nerve was calculated for each animal. Figure 2 shows the mean ratio of tectal radioactivity at each time point. A ratio of

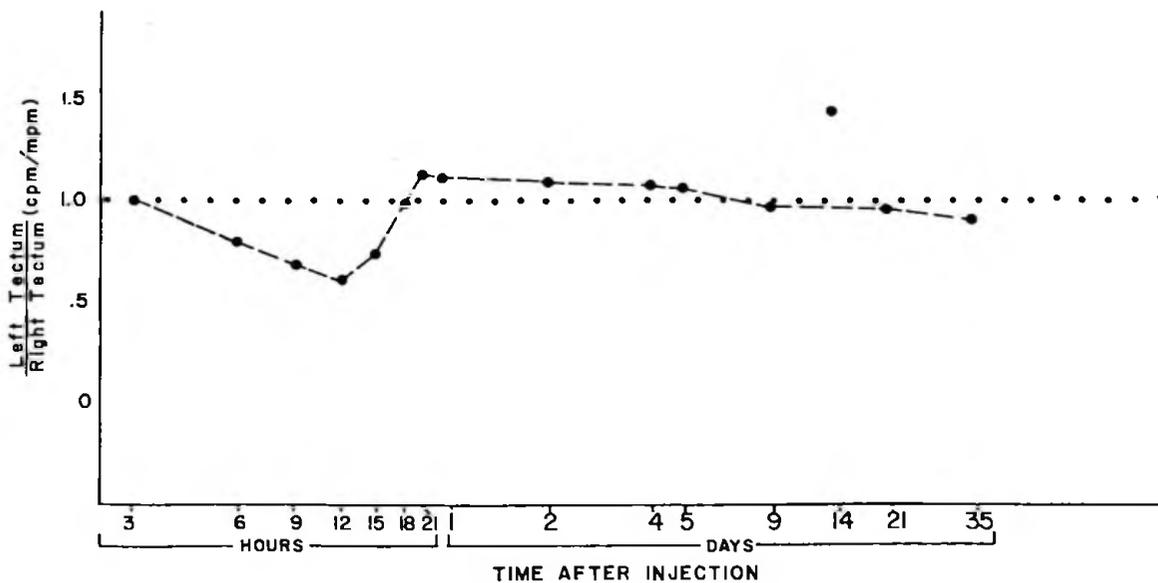


Figure 2

less than 1 at 6 to 15 hours indicated relatively greater accumulation in the tectum connected to the short nerve and a ratio of greater than 1 from 15 to 24 hours indicates the arrival of label in the tectum connected to the long nerve. Thus these data suggest that the fast transport system is not greatly influenced by length of axon.

Preliminary results indicating the absence of such a difference in the level of radioactivity in the 2 tecta at later times suggest that the slowly moving proteins arrive in the tecta at approximately the same time, i.e., that the rate of transport may be greater in the longer nerve than in the shorter nerve, and therefore may be a function of length of axon. This is supported by a comparison of the distribution of radioactivity in the 2 sides, indicating a different distribution in nerves but similar levels in the tracts and tecta (Fig. 3).

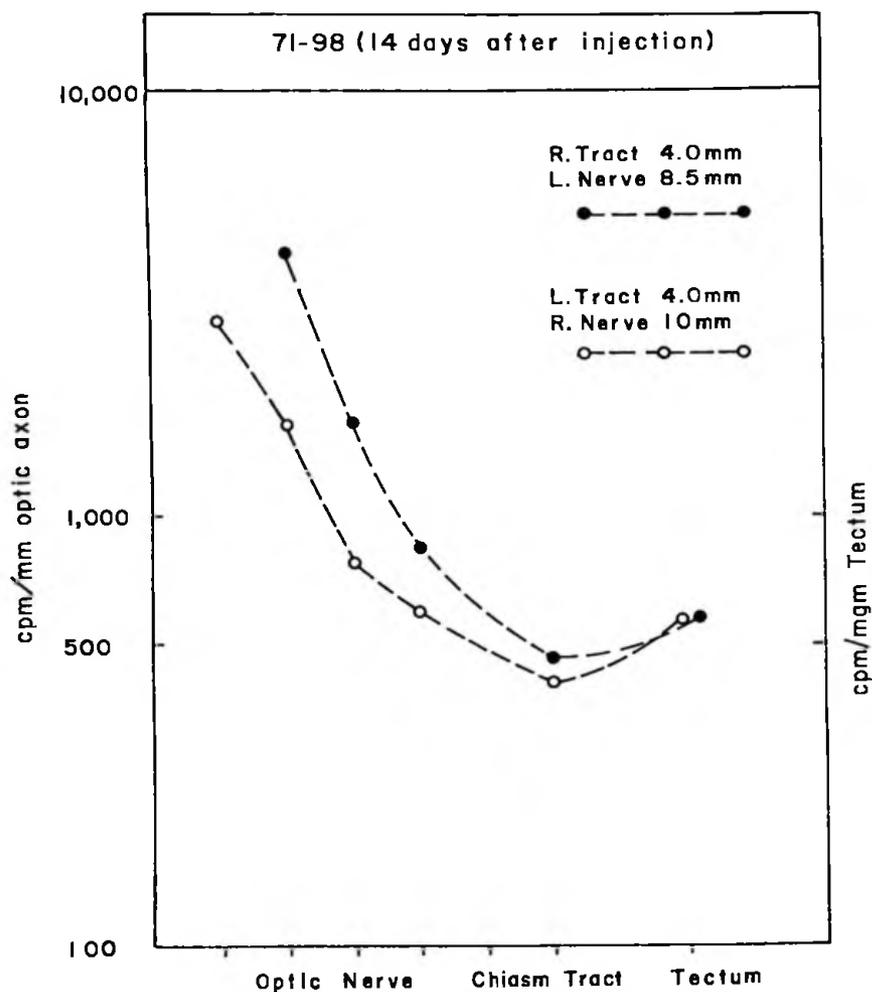


Figure 3