Squalus acanthias have also been processed for electron microscopy. The gross structure of the spiral valve permits the application of hydrostatic pressure with minimal distension of absorptive surfaces.

Histochemical studies designed for localization of sodium in the intra-epithelial intercellular space have been continued using potassium antimonate in the perfused spiral valve and in slices of the rectal glands. The configuration of the intercellular space has been examined using the peroxidase method of Graham and Karnovsky. These preparations will be subjected to electron microscopic examination and the results reported subsequently.

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1968 #13

UREA TRANSPORT BETWEEN BLOOD, BRAIN, AND CEREBROSPINAL FLUID IN Squalus acanthias

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Urea is a small water soluble molecule which moves across most biological membranes quite rapidly; however, in mammals the transport of urea between blood and brain and between blood and cerebrospinal fluid (CSF) is curiously slow. In view of this and the importance urea plays in the osmotic balance of elasmobranchii, a preliminary study of the exchange of urea between blood, brain and CSF (also called ventricular fluid) in Squalus acanthias was begun.

Tracer amounts of ^{14}C-urea were injected intravenously into dogfish and plasma radioactivity was maintained relatively constant. The animals were sacrificed at various times and plasma, brain, choroid plexus, and CSF samples were taken. Employing a freezing microtome, the brain samples (medulla only) were rapidly frozen and sliced into sections parallel to the ventricular surface. Four such sections were obtained starting from the inner or ventricular surface and ending with the outer or dural surface. The results are presented in the table. It

Table 1

^{14}C-UREA SPACE ÷ WATER SPACE AT VARIOUS TIMES FOLLOWING IV INJECTION

	30 min	1 hr	2 hr	18 hr
CSF (100%)*	1.00	1.01	1.06	1.08
Choroid Plexus (90%)*	1.00		1.43	1.17
Medulla (79%)*				
inner	.49	.53	.86	1.02
	.34	.38	.75	1.00
	.23	.30	.71	1.00
outer	.16	.25	.63	1.00

*Water space.

can be seen that the ^{14}C-urea activities in the CSF and choroid plexus water spaces equal that of the plasma within 30 minutes, and thereafter their relative activity is greater than that of the plasma. The significance of the value of 1.08 (see table) is not known at present. The brain tissue itself takes up tracer urea from the blood more slowly; however the tissue next to the CSF (labeled "inner" in the table) appears to equilibrate more rapidly than the deep tissue. This is probably the result of diffusion of ^{14}C-urea from the CSF into the adjacent tissue as well as direct uptake of tracer from the blood.

In another group of experiments the uptake of ^{14}C-urea by pieces of choroid plexus tissue incubated at 12-15°C was studied. The entry of tracer urea was exceedingly fast. The ratio of ^{14}C-urea in choroid plexus water to ^{14}C-urea in the medium was greater than one in two minutes and remained constant (ratio = 1.2-1.4) after ten minutes.

From these studies it appears that the transport of urea between blood and CSF is rapid and may be uphill. Urea exchange between blood and brain seems to be slower and not concentrative. Also, these studies and others to be reported in this journal suggest that urea moves freely between CSF and brain. This probably occurs by diffusion.

1968 #14

RELATION OF TRANSPORT COMPETITION TO CARRIER SATURATION IN THE ACTIVE SECRETION OF ORGANIC ACIDS BY THE AGLOMERULAR KIDNEY OF THE GOOSEFISH, Lophius

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Earlier transport studies on isolated flounder renal tubules showed that maximal transfer rates for various organic acids secreted by a common carrier differ, and that the more slowly transported compounds were relatively the more effective competitive inhibitors (Foster et al., J. Cell. Comp. Physiol. 44:315-18, 1954). These also had the tendency to accumulate intracellularly during transit across proximal tubule cells (Foster, R. P., and S. K. Hong, J. Cell. Comp. Physiol. 51:259-72, 1958). In the aglomerular kidney of Lophius the maximal tubular transfer rate (Tm) of p-aminohippurate (PAH) was found to be four times that of iodopyracet (Diodrast). However, when these transport competitors were presented simultaneously in equimolar concentrations with plasma levels of each sufficiently high to saturate the carrier system, the relative excretion rates were reversed with the iodopyracet transfer rate then four times that of PAH. The combined excretion rate was far below Tm_{PAH} alone, and roughly equal to Tm_I (Forster, R. P., and S. K. Hong, J. Gen. Physiol. 45:811-20, 1962). On this basis it appeared that iodopyracet had the higher affinity for the secretory mechanism, and the situation presumably was comparable to that of carrier-mediated transport of different sugars across the erythrocyte membrane under conditions approaching saturation of the transfer mechanism when penetration rates are proportional to K_m, i.e., inversely proportional to affinity for carrier.

The current preliminary studies were undertaken to observe the transport rates of these two organic acids measured separately, and simultaneously as competitors under conditions of equimolar loading, when there is low saturation of carrier at plasma levels less than that needed to achieve Tm values.

Chemical methods and techniques used in handling the fish were similar to those of the