1972 #32

PILOT STUDIES ON THE CHEMISTRY OF CRANIAL FLUID AND PERILYMPH IN *Squalus Acanthias*

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During the experiments on endolymph physiology and chemistry reported elsewhere in this volume (Addink *et al.*, Bulletin, 12, 1972), we also sampled cranial (extra-dural) fluid and perilymph. No data exist on electrolyte concentrations of these fluids in *S. acanthias;* Murray and Potts (Comp. Biochem. Physiol. 2:65, 1961) reported on their composition in *Raja clavata.* Rates of accession of ions to these fluids have not been studied in any species. We now give preliminary data on both these subjects.

These two fluids are both directly beneath and in contact with the chondocranium. Unlike cerebrospinal fluid, aqueous humor, or endolymph, these two fluids contain protein and a chondroitin-like substance. The proteins of the cranial fluid have been studied by Rasmussen and Rasmussen (Chapter 25 in *Sharks, Skates, and Rays*, Johns Hopkins Press, 1967).

TABLE 1

ELECTROLYTE COMPOSITION OF CRANIAL FLUID AND PERILYMPH IN *S. ACANTHIAS* (mM)

	Na^+	K^+	Cl^-	CO_2
Plasma	256	4.1	230	7.6
Cranial (n=2)	270	3.2	240	7
Perilymph	253	3.3	266	10

See Addink *et al.* (This Bulletin) for standard errors of plasma and perilymph figures.

Table 1 gives the electrolyte composition of the two fluids. They are approximately the same as that of plasma with the possible exception of somewhat low K^+ in both fluids and high Cl^- in perilymph. Urea was kindly analyzed by Dr. Bodil Schmidt-Nielsen who found both fluids to have the same concentration as plasma, about 350 mM.

The effect of hypercapnia was studied by addition of five percent CO_2 to sea water perfusing the spiracles and gills (Maren, Am. J. Physiol. 222:885, 1972). This was carried out for as long as four and a half hours in a total of seven experiments for cranial fluid and four for perilymph. No change in concentration was observed in any electrolyte; this may be contrasted to striking elevations in total CO_2 in CSF which were observed in the same fish. This effect has been documented previously (*vide supra*).

TABLE 2

RATE CONSTANTS (k_{in}) FOR ACCESSION OF IONS FROM PLASMA TO CRANIAL FLUID AND PERILYMPH

	Na^+	$K^+(RB^+)$	Cl^-	HCO_3^- (total CO_2)
			Hr^{-1}	
A. NORMAL				
Cranial	0.13 (n=4)	0.09 (1)	0.08 (4)	0.52 (2)
Perilymph	0.09 (1)	0.15 (1)	0.13 (2)	0.12 (3)
B. CARBONIC ANHYDRASE INHIBITED*				
Cranial	0.07 (2)	-	0.08 (1)	0.19 (3)
Perilymph	0.05 (1)	-	0.12 (2)	0.15 (3)

*80 mg/kg acetazolamide 24 hours before injection of isotope.

Table 2A gives the accession rate constants of the ions to these fluids, measured in the same way as previously described for CSF *(vide supra)* and for endolymph (Addink, *et al.* This Bulletin, 12, 1972). Despite the small number of samples, the data permit the suggestion that the movement of the two fluids may be in part controlled by different forces, with the cranial moving more rapidly and with a much higher turnover of HCO_3^-. Table 2B supports this idea in suggesting a decrease in the Na^+ and HCO_3^- accession during carbonic anhydrase inhibition.

The function, origin, and flow pattern of cranial (or extra-dural) fluid, which is found in considerable volume between the brain and skull of many elasmobranch and teleost fish, are entirely unknown. The perilymph is equally unknown, but cannot be ignored in otic physiology. This report is designed to indicate future possibilities in the study of these important substances.

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1972 #33

THE DISTRIBUTION OF L-ASPARAGINE SYNTHETASE IN THE ORGANS OF VARIOUS MARINE ANIMALS

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L-Asparagine synthetase catalyzes the formation of L-asparagine from L-aspartic acid and L-glutamine in the presence of ATP and magnesium ions. Conversely the oncolytic enzyme L-asparaginase