HEMODYNAMICS OF THE PERFUSED *SQUALUS ACANTHIAS* PUP HEAD: SENSITIVITY TO IN VIVO LEVELS OF EPINEPHRINE

David H. Evans and Craig Hooks, Department of Zoology, University of Florida, Gainesville, Fl.

We have recently initiated a series of studies of the hemodynamics and transport characteristics of the perfused head of *Squalus acanthias* pups (Evans and Claiborne, J. Exp. Biol. 105:363-371, 1983; Evans et al. Bull. MDIBL 22:46-47, 1982) and have found that this preparation is hemodynamically stable for periods of hours and displays Cl and ammonia effluxes near to those found in the intact fish. Like other perfused head preparations (eg. Claiborne and Evans, J. Comp. Physiol. 138:79-85, 1980), the pup head reacts to the addition of 10^{-5}M epinephrine with a transient, alpha-adrenergic mediated increase in vascular resistance (not always present), followed by a longer lasting, beta-adrenergic mediated fall in vascular resistance (Evans and Claiborne, 1983, Op. Cit.). However, 10^{-5}M epinephrine is substantially greater than the resting levels of 3.2×10^{-8}M found in *Scyliorhinus canicula* (Butler et al., J. Comp. Physiol. 127:325-330, 1978). It is even substantially above the concentrations of 4.5×10^{-7}M found in *S. canicula* under hypoxic conditions. Shuttleworth (J. Exp. Biol. 103:193-204, 1983) has recently shown that the secretory rate of the perfused rectal gland of *S. canicula* is sensitive to catecholamine concentrations of this magnitude (ie. 5×10^{-8}M to 10^{-6}M), so it is appropriate to examine the sensitivity of the branchial vasculature of the *S. acanthias* pup head to levels of epinephrine which more nearly approximate the in vivo condition.

Pup heads were prepared as described previously (Evans and Claiborne, 1983, Op. Cit.) and were perfused for 15 to 30 minutes to clear the branchial vasculature of blood, and to reach stable afferent pressures. (Temperature of the preparation was controlled by running the perfusate through a coiled tubing in a bath maintained at approximately 10° C by a cooling plate. In addition, the irrigation fluid was maintained at approximately 10° C with another cooling plate. In this way the temperature of the perfusate and irrigate were approximately 12°-14° C as they entered the head). After stable afferent pressures were obtained, the perfusate was changed to contain epinephrine in concentrations ranging from 10^{-8}M to 10^{-6}M and the change in afferent pressures was noted. In many cases, the effects of the epinephrine were transient, ie., an initial fall followed by a relatively slow (few minutes) increase in pressure. In this case the fall in pressure calculated for a subsequent increase in epinephrine concentration was taken as the difference between the final pressure at the first concentration and the initial drop in pressure at the next highest epinephrine concentration.

Table 1 presents the results and it is quite clear that epinephrine is effective at reducing the resistance of the

Table 1.--Effects of low concentrations of epinephrine on the afferent pressure of the perfused pup head

	10^{-8}M	5×10^{-8}M	10^{-7}M	10^{-6}M
Pressure Change (torr)	-6.3 ± 3.1*	-5.1 ± 0.6	-3.8 ± 1.3	-8.0 ± 0.7

*$\bar{X}$ ± S.E. (N=4).

branchial vasculature at extremely low concentrations, certainly in the range of in vivo levels. Thus, it appears that the resistance of the elasmobranch branchial vasculature is tonically maintained by circulating catecholamines. Importantly, these data also indicate that the hemodynamic effects of epinephrine on the isolated, perfused pup head demonstrated at higher concentrations (Evans & Claiborne, 1983, Op.Cit.) cannot be ascribed to pharmacological levels of the hormone. Supported by NSF PCM 81-04046 to DHE.

UREA EFFLUXES FROM THE *SQUALUS ACANTHIAS* PUP: THE EFFECT OF STRESS

David H. Evans and Craig Hooks, Department of Zoology, University of Florida, Gainesville, Fl.

The extremely high concentration of urea found in elasmobranch blood is secondary to nearly complete re-