EFFECT OF ATRIAL NATRIURETIC PEPTIDE ON GILL TRANSPORT IN ANGUILLA ROSTRATA

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Secretory granules containing cardiac peptides are widely distributed in the vertebrate evolutionary tree. They have been reported in the myocytes of mammals, birds, reptiles, amphibians and elasmobranchs (Squalus acanthias) as well as in a freshwater teleost (Carassius auratus). Cardiac peptides appear to operate in diverse ways to reduce the salt content of the body. It was therefore of interest to examine the effect of a purified, atrial natriuretic peptide (rat ANF_{II}, Peninsula Laboratories) on ^{36}Cl efflux across the gills in the euryhaline teleost, Anguilla rostrata.

Gill efflux was measured in intact unanesthetized specimens of Anguilla rostrata trapped in Frenchman Bay or in New Brunswick, Canada. Eels were acclimatized to seawater or running tap water for at least 10 days at 16°C before a test. Eels weighing 50 to 250 gm were immersed in 1000 ml of oxygenated seawater, injected intraperitoneally with 1-2 μCi of ^{36}Cl (Amersham, sp. act. 5 $\mu Ci/10^{-5}$ M), in phosphate buffer and allowed to equilibrate for 30 min before sampling the bath. One ml samples of bath water were then removed at intervals of 30 min for a total of 120 min and placed in 9.1 ml of Aquasol.(R) ANF in 0.2 ml isotonic phosphate buffer, or an equal volume of phosphate buffer alone was injected intraperitoneally at the end of 60 min. At the end of the experiment approximately 0.3 ml of blood was aspirated from the dorsal vein into a 1 ml heparinized syringe, spun down in an Eppendorf centrifuge, and 0.1 ml plasma was also placed in 10 ml Aquasol(R) for determination of radioactivity by scintillation counting. The plasma clearances of ^{36}Cl were calculated from the radioactivity excreted into the bath and the residual radioactivity in the plasma. Under these circumstances, practically all of the radioisotope appearing in the seawater bath is excreted by the gills.

In 8 eels adapted to seawater, a dose of 10 μg ANF per 100 gm body weight increased plasma clearance of ^{36}Cl by 2.38±0.83 ml/100 gm/hr (mean ± s.d.), from 5.04±2.07 to 7.42±3.05, $p<0.05$. No significant effect was obtained when injections of diluent were given intraperitoneally to 5 control eels (average increase 0.91±1.38 ml/100 gm/hr). A small effect to increase ^{36}Cl clearance was also seen in 8 freshwater eels at this dose, with an increase in plasma clearance from 0.45±.30 to 1.81±.74 ml/100 gm/hr during the first 30 min after ANF was injected. In 8 control freshwater eels the increase in gill efflux produced by placebo injection was significantly smaller (0.27±0.10 to 0.87±.33). Lower doses of ANF (1-3 μg/100 gm) given intraperitoneally through an indwelling PE10 catheter failed to produce a significant increase in chloride efflux in either seawater (n=8) or freshwater (n=5) eels.

These preliminary results suggest that mammalian cardiac peptides (rat ANF_{II}) may increase chloride efflux across teleost gills. Because it is likely that in fish as in mammals the circulating peptide has a short half-life, further experiments appear warranted in which chloride cells of the gill or operculum are exposed to a high concentration of cardiac peptides for a prolonged period of time.