THE MUDSKIPPER *Periophthalmodon Schlosseri*

EXCRETES PROTONS TO LOWER EXTERNAL PH

AND TOXICITY OF AMMONIA

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EXTENDED ABSTRACT ONLY - DO NOT CITE

Many teleosts adopt the strategies of detoxifying ammonia to urea and/or glutamine during ammonia loading situations (Mommsen and Walsh, 1991). To date, only the mudskipper *Periophthalmodon schlosseri* is known to actively excrete ammonium ion in conditions of elevated ambient ammonia (Randall et al., 2000). Using artificial burrows made of rubber hose, we demonstrated that *P. schlosseri* was capable of sequestering at least 10 mM of ammonia to the external environment. Active pumping of NH_4^+ is energetically much more efficient than turning ammonia into urea or glutamine. One mole of ATP is utilized for every two moles of NH_4^+ eliminated. However, for such a mechanism to function, there must be means for the fish to prevent the back diffusion of NH_3 once the level of ammonia builds up in the environment. Therefore, it is logical to assume that this mudskipper would possess plasma membranes relatively impermeable to NH_3 and/or be capable of acidifying the external medium to keep NH_4^+ in the ionized form.

Our results verified that *P. schlosseri* was capable of manipulating the pH of the external medium. When placed in three and a half times its own volume of 50% seawater at pH 8 and pH 9 in the presence of 2 mM Tris buffer, *P. schlosseri*

could lower the external pH by 0.6 and 1.30 units, respectively, within 6 h. Stabilization of pH at a value aound 7 occurred after approximately 12 h. This acidification occurred even if carbon dioxide excretion is removed by aeration.

Furthermore, *P. schlosseri* responsed to the presence of NH_4Cl in the external medium by increasing the rate of excretion of proton equivalent. This unique capability of *P. schlosseri* to excrete proton equivalents in response to the presence of ammonia in the external medium would maintain the actively excreted NH_4^+ in the ionized form and prevent it from diffusing back to the tissues as NH_3.

In its natural habitat, acidification of a small amount of burrow water by *P. schlosseri* is feasible since the burrow is poorly flushed. Mudskippers are the only fish known to rear the developing embryos in their burrows. The growth of embryos requires the mobilization of yolk and results in ammonia production and accumulation in the burrow water. Acidification of the burrow water lowers the concentration of NH_3 in the external medium and therefore reduces the toxicity of ammonia to both the embryos and the fish themselves.

References

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