A proposed novel mechanism for Na+ transport in rainbow trout gills

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The molecular identity of the Na^+ uptake mechanism across the gills of freshwater fish remains the subject of lively debate. Extensive evidence for NHE mediated Na^+ uptake exists, especially for zebrafish. However, thermodynamic constraints on the function of NHEs at low ion concentrations (Na<0.5mM) and low environmental pH's suggest alternate mechanisms may need to exist in those species exploiting these environments. Efforts to identify ENaC homologues in teleost fishes have not been successful. We investigated if alternative sodium channels could play a role in Na^+ uptake in rainbow trout. Here we demonstrate the presence of an acid sensing ion channel (ASIC), a member of the ENaC/DEG superfamily of Na^+ channels that is expressed in MR cells. We report the inhibition of Na^+ uptake in very soft water using ASIC specific pharmacological blockade and suggest that this channel may be responsible for Na^+ uptake in freshwater fish in very soft water.