Identification and mapping of urea- and ion-transporting molecules in the kidney of cartilaginous fish

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Cartilaginous fish (sharks, skates, rays and chimaeras) maintain their plasma osmolality slightly hyperosmotic to surrounding seawater primarily through the retention of urea to overcome hyperosmotic stress in a marine environment. In the kidney, more than 90% of filtered urea is reabsorbed from primary urine and returned to the blood, thereby reducing the urinary loss of urea. However, the renal tubules of marine cartilaginous fish are highly elaborate, and the mechanism for urea reabsorption is still largely unknown. Therefore, we cloned mRNAs encoding transporting proteins for urea and ions in cartilaginous fish, and then used immunohistochemistry and/or *in situ* hybridization to determine their location in the nephron. From this we could deduce the movement of urea and ions in the kidney tubules. In this talk, we will report 1) that in the houndshark, *Triakis scyllium*, membrane localization of urea transporter is dependent on environmental salinity, 2) the identification of multiple urea transporters in the elephant fish (holocephalan), *Callorhinchus milii*, and 3) the localization of ion-transporting molecules that are probably involved in the urea reabsorption system. Based on these results, we discuss a possible mechanism for urea reabsorption in the kidney of cartilaginous fish.