Functional architecture of the urinary concentrating mechanism in desert rodents

Thomas L. Pannabecker, Department of Physiology, University of Arizona, USA

The kidneys of mammals that inhabit arid environments and that concentrate their urine to over 6000 mOsm/Kg water, should provide extreme examples of structural and functional relationships associated with production of concentrated urine. Although correlations between medullary architecture and the ability of desert species to form a high urine concentration are known, the relationships are often unpredictable and overall mechanisms are poorly understood. We have shown two distinct interstitial compartments exist in the renal inner medulla of the kangaroo rat *Dipodomys merriami* and the Munich-Wistar rat. Water-permeable descending thin limbs and descending vasa recta associate with highly water-permeable ascending vasa recta (AVR) in one interstitial compartment that is devoid of collecting ducts (CDs). In a second compartment, ascending thin limbs (ATLs) and AVR form arrays of discrete microdomains lying adjacent to CDs. Fluid and solute reabsorbed from CDs and ATLs likely diffuse preferentially into these AVR, through which they ascend to higher axial levels or return to general circulation. These two compartments in the renal inner medulla define multiple countercurrent systems that may underlie renal adaptation to water conservation. (Support: NSF IOS-0952885; NIH R01DK083338)