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Functional anatomy for urinary acidification

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Kidney plays a critical role in acid-base homeostasis by the reabsorption of filtered bicarbonate (HCO_3^-) and the generation of new HCO_3^-. In the proximal tubule, HCO_3^-reabsorption occurs via the transcellular coupling of the apical Na^+/H^+exchanger with the basolateral $Na^+(HCO_3^-)$ cotransporter, which plays a critical role in mediating electrogenic bicarbonate efflux. In the cortical distal nephron, acid secretion is primarily mediated by a vacuolar H^+-ATPase and H^+-K^+-ATPase located in the apical plasma membranes of type A-intercalated cells. Basolateral bicarbonate efflux is mediated by the anion exchanger AE1 in this cell type. In type B- intercalated cells, the vacuolar H^+-ATPase is located on the basolateral membrane. This cell type is thought to mediate collecting duct HCO_3^- secretion via an apical anion exchanger pendrin. In addition to the $Na^+(HCO_3^-)$ cotransporter, which mediates electrogenic basolateral HCO_3^- transport in the proximal tubule, other members of the $Na^+(HCO_3^-)$ cotransporter family have been identified and functionally characterized. Renal ammonia excretion is the predominant component of renal net acid excretion. In the proximal tubule, the apical Na^+/H^+exchanger is a major mechanism of preferential NH_4^+ secretion. In the thick ascending limb of Henle, the apical Na^+-K^+-$2Cl^-$ cotransporter is a major route to ammonia reabsorption and the basolateral Na^+/H^+exchanger appears to be the basolateral NH_4^+ exit. The collecting duct is a major site for renal ammonia secretion. The Rhesus glycoproteins, Rh B Glycoprotein (Rhbg) and Rh C Glycoprotein (Rhcg), are recently recognized ammonia transporters in the distal tubule and collecting duct. The localization and function of these acid-base transporters in the kidney tubules are to be discussed.