Differentiation of pendrin-positive cells in developing mouse kidney

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The pendrin, a novel apical Cl/HCO_3^- exchanger, is present in the apical domain of type B and nonA-nonB intercalated cells in mouse kidney. The purpose of this study was to determine the exact time of appearance of pendrin-positive cells and to follow their differentiation in the developing mouse kidney. Mice kidneys from 13-, 14-, 15-, 16-, 18-, and 19-day-old fetuses, and 1-, 4-, 7-, 14-, and 21-day-old pups were processed for light microscopic immunohistochemistry. Cells with apical pendrin immunolabeling appeared first in the connecting tubule (CNT) at 15 days of gestation and outer part of the medullary collecting duct (MCD) at 18 days of gestation. There was no pendrin-positive cells in the cortical collecting duct (CCD) until 1-day-old pups. Pendrin-positive cells appeared in the inner part of the CCD of 4-day-old pups and in the outer part of the CCD of 7-day-old pups. Pendrin-positive cells were markedly increased in number in the CNT at 1-day-old pups, in the MCD at 7-day-old pups, and in the CCD at 14-day-old pups. In contrast, pendrin-positive cells gradually disappeared from the inner part of MCD after 14-day-old pups. This results of this study suggest that pendrin-positive cells differentiate prenatally from precursor cells both in the CNT, which is derived from metanephrogenic blastema, and MCD, which is derived from ureteric bud. The striking increase in number of pendrin-positive cells observed after birth suggest that there is an activation of HCO_3^- secreting pendrin-positive cells shortly after birth.

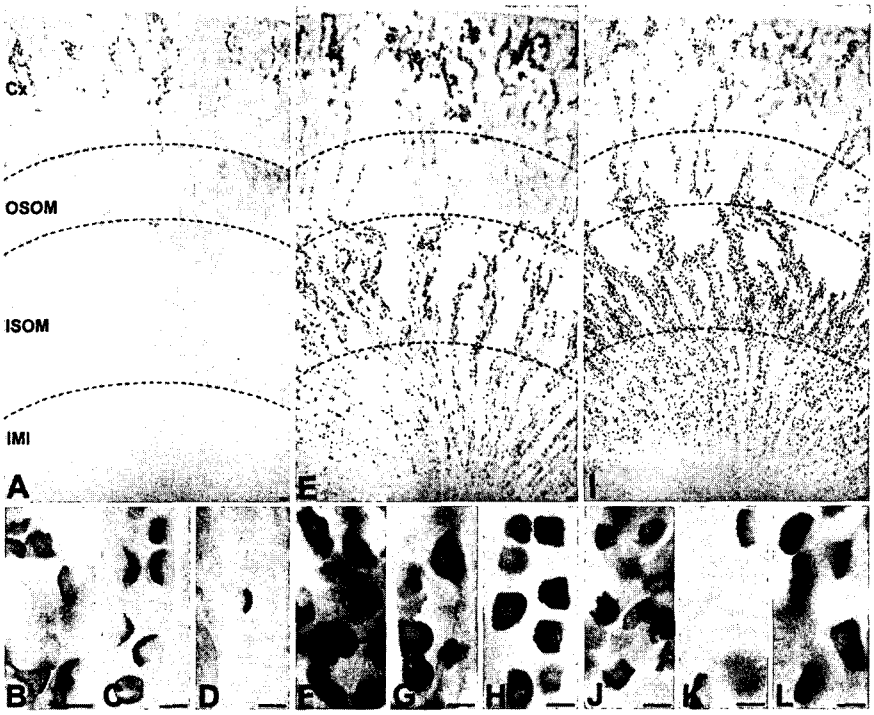

Fig. 1. Light micrographs of 50-㎛-thick vibratome sections from adult mouse kidney illustrating immunostaining for pendrin (**A-D**), H^+-ATPase (**E-H**) and anion exchanger 1 (AE1) (**I-L**). **A**. Pendrin immunoreactivity is present in the connecting tubules (CNT) and the cortical collecting ducts (CCD) of the cortex (Cx) and the outer medullary collecting duct (OMCD) of outer stripe of outer medulla (OSOM). **E** & **I**. Strong H^+-ATPase and AE1 immunoreactivity is present in CCD, OMCD, and initial part of inner medullary collecting duct (IMCDi). **B-D**. Higher magnification of pendrin-positive cell in CNT (**B**), CCD (**C**) and OMCD of OSOM (**D**). Pendrin immunoreactiviy is expressed in apical plasma membrane and supra nuclear region. **F-H**. Higher magnification of H^+-ATPase-positive cell in CNT (**F**), CCD (**G**) and OMCD of inner stripe of outer medulla (ISOM) (**H**). H^+-ATPase immunoreactivity is diverse such as apical, bipolar, or diffuse labeling in CNT, CCD and OMCD of ISOM. **J-K**. Higher magnification of AE1-positive cell in CNT (**J**), CCD (**K**) and OMCD of ISOM (**L**). AE-1 immunoreactivity is expressed at basolateral membrane in CNT (**J**), CCD (**K**) and OMCD of ISOM (**L**). Cx, cortex; OSOM, outer stripe of outer medulla; ISOM, inner stripe of outer medulla; IMi, initial part of inner medulla. **A**, **E**, **I** scale bars = 50 ㎛ **B-D**, **F-H**, **J-L** scale bars = 10 ㎛

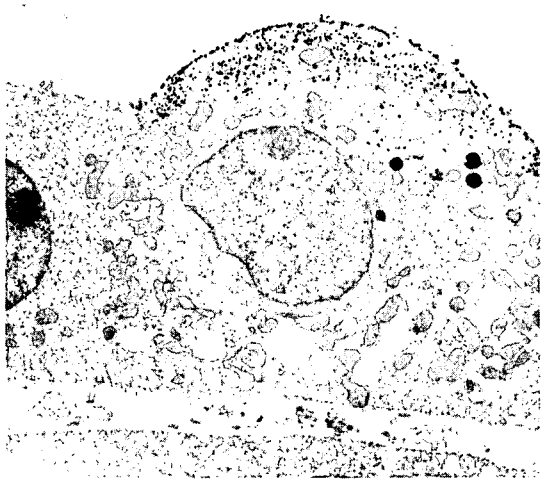

Fig. 2. Transmission electron microscopic localization of pendrin in the mouse adult kidney. Pendrin-positive immunogold particles are located at supranuclear region and apical plasma membrane of type B intercalated cell. Bar = 1 ㎛.