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Structural-immunohistochemical Characteristics of Henle's Loop in Mouse Kidney

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The mouse kidney displays an extreme urine-concentrating capacity and has special anatomical-functional adaptations that improve its concentrating ability. Any extrapolation to other species should take into account several features of mice relative to those of other mammals, such as their great urine-concentrating capacity and different kidney adaptations. Unfortunately, these special adaptations are too often ignored, and this may weaken or even invalidate the conclusions of some recent mouse studies, even though the use of the mouse as a transgenic animal model for the study of kidney disease is increasing. It is known that Henle's loop has a unique structure and plays a major role in the urinary concentrating mechanism. This study provides new detailed information on immunohistochemical characteristics for AQP1 and UT-A, and an epithelial ultrastructure of descending thin limbs (DTL) at well-defined positions along Henle's loop in mouse kidney. In type I epithelium of short-looped DTL, which is composed of very flat and non-interdigitating cells without microvilli, AQP1 expressed faintly only in the upper 1/2 part whereas no AQP1 immunoreactivity was found in terminal 1/2 part. In contrast, UT-A expressed strongly in the terminal 1/2 part, whereas no UT-A immunoreactivity was observed in the upper 1/2 part. The long-looped DTLs were lined by two distinctly differented epithelia : The epithelium of the upper part of inner stripe of outer medulla (ISOM) was characterized by complex and highly differentiated apical and basolateral membranes and radially oriented mitochondria (type II). The epithelium of the long-looped DTL located in the innermost part of ISOM and inner medulla (IM) was characterized by many thin luminal microvilli and numerous finger-like infoldings of the basal membrane, fewer and less shallow tight junction (type III). The DTLs of shorter long-loops of Henle, which bend were located at various levels of the IM, were lined by two distinctly differented epithelia. The epithelium of the upper part of ISOM was type II, whereas the epithelium of the innermost part of ISOM and IM had ultrastructural characteristics of type I epithelium. In this type II epithelium, AQP1 was strongly expressed, whereas no UT-A immunoreactivity was observed. In type I epithelium of shorter long-loop, immunoreactivity for UT-A and AQP1 was weak in the innermost part of ISOM, but not in the IM part. From these observations, we conclude that three types of DTL of Henle's loop were identified to relate to the length and by ultrastructural and immunohistochemical characteristics in mouse kidney.