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The Excretion of Urea by the Perfused Kidney of the Bullfrog, *Rana catesbiana*

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Nussbaum reported, almost 80 years ago, that the frog kidney deprived of its arterial blood supply can excrete urea. Richards, Bott and Walker (1938) demonstrated that phenol red could be secreted by the tubule of the doubly perfused bullfrog kidney in the absence of significant glomerular filtration but the tubular excretion of urea in the perfused kidney has never been satisfactorily confirmed.

Pithed Louisiana bullfrogs were used for all experiments. Two preparations were used: 1) Single perfusion. Polyethylene cannulae were tied in both renal portal veins and perfused anteriorly at low pressures (10-20 cm. H₂O). Both ureters were cannulated for the collection of urine and the perfusate was collected from the cannulated vena cava. The aorta was ligated anterior to the renal arteries. 2) Double perfusion. The aorta was also cannulated and perfused posteriorly at a higher pressure.

The perfusates consisted of oxygenated buffered Ringer's solution. The portal perfusate contained urea (50 or 100 mg/100 ml) and creatinine (50 or 100 mg/100 ml). The aortic perfusate contained neither urea nor creatinine, but did contain sodium ferrocyanide (5 mg/100 ml).

Perfusion of the portal vessels alone resulted in very sluggish urine flow (0.02-0.04 ml/kg/hr). Creatinine was always present, indicating that some filtration did occur. Creatinine urine/perfusate ratio (U/P) ranged from 0.19 to 0.62. Water was, therefore, added to the urine after filtration. Urea U/P varied from 1.1 to 2.5, indicating that urea entered the urine by tubular excretion. Osmotic U/P ratios were 0.36-0.57.

When both aorta and portal veins were perfused, greater urine flow was obtained (0.2-2 ml/kg/hr). Creatinine U/P was low (0.002-0.28) and exceeded by urea U/P (0.08-0.66). Ferrocyanide U/P was always above one. Osmotic U/P fell between 0.13 and 0.43.

In both preparations a portion of the portal perfusate reached the glomeruli and pure tubular urine was never obtained. Urea was apparently added by tubular excretion, however, since the urea clearance was consistently above that of creatinine. The presence of filtration makes it impossible to determine the significance of the hypotonicity of the urine. This type of preparation, particularly the double perfusion, could be useful, nevertheless, for investigation of tubular excretory mechanisms.

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