Ward's Renal Lobule Model

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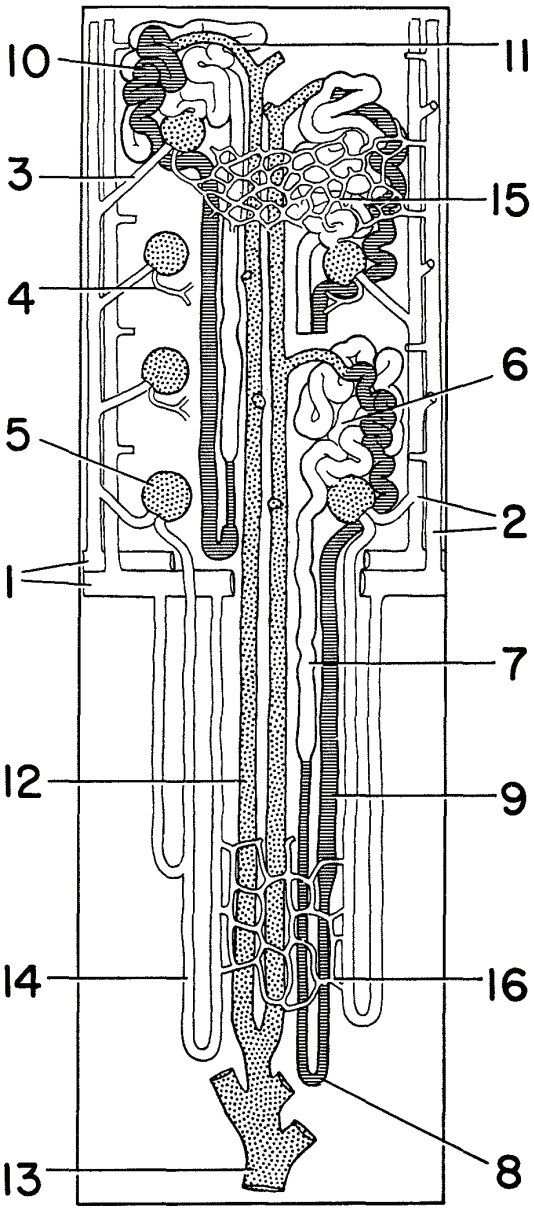
1. Arcuate artery and vein.
2. Interlobular artery and vein.
3. Afferent glomerular arteriole.
4. Efferent glomerular arteriole.
5. Renal corpuscle (glomerulus plus Bowman's capsule).
6. Proximal convoluted tubule.
7. Descending thick limb of Henle's loop.
8. Thin segment of Henle's loop.
9. Ascending thick limb of Henle's loop.
10. Distal convoluted tubule.
11. Arched connecting tubule.
12. Collecting tubule.
13. Papillary duct of Bellini.
14. Vasa recta.
15. Capillary bed of cortex (extends through entire cortex).
16. Capillary bed of medulla (extends through entire medulla).

MANY more banks of glomeruli occur in the cortex than are represented on the model, and the proportionate length of the medullary elements has been greatly reduced. The fundamental physiological unit of the kidney is the nephron, consisting of the glomerulus, Bowman's capsule, the proximal convoluted tubule, Henle's loop, and the distal convoluted tubule. The blood is filtered in the glomerulus, water and soluble substances, except blood proteins, passing into Bowman's capsule in the same proportions as they occur in the blood. In the proximal tubule water and certain useful substances are resorbed from the provisional urine, while some further components may be added to it by secretory activity on the part of the tubular epithelium. In the remainder of the tubule, resorption of certain substances is continued, while the urine is concentrated further by withdrawal of water. The finished urine flows through the collecting tubules without further change.

Various kinds of loops occur, varying in length of the thin segment, and in the level to which they descend into the medulla. The outermost glomeruli have the shortest loops, and some loops have been described which lack the thin segment entirely. Each loop, however, returns to the vascular pole of its own glomerulus, where it makes contact with the afferent arteriole. The size of the glomerulus varies with the length of the loop, those nearest the medulla being the largest. The glomeruli can be divided into two types on the basis of their vascular relationships. In the outer banks, or *cortical* glomeruli, the efferent arteriole is 1/3 to 1/5 the diameter of the afferent, and breaks up immediately into a capillary bed, which first supplies the medullary ray, then passes over to the convoluted portion of the tubules. In the innermost, or *juxtamedullary* glomeruli, the efferent arteriole is as large or larger than the afferent, and passes immediately into the medulla, where it divides to form a bundle of large caliber vessels (vasa recta), which furnish a capillary bed to the medulla, and turn back at various levels to join the arcuate vein, either immediately, or by way of the interlobular veins.

It is probable that blood is normally more or less equally distributed to all the glomeruli. But it can be demonstrated that in response to certain stimuli (shock, infection, toxins, etc.) blood fails to reach the outer levels of the cortex, and instead passes through the juxtamedullary glomeruli, through the vasa recta, and into the arcuate vein. Thus the major part of the cortex is by-passed, the secretion of urine stops, and arterial blood flows away from the kidney by way of the renal vein. The existence of this by-pass is supposed to explain certain types of kidney pathology.



For further information on the circulation of the kidney, see Josep Trueta, *et al., Studies on the Renal Circulation*, Charles C. Thomas, Springfield, Ill., 187 pages, 1947.

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