Glomerulus Model

with Cross Sections of Kidney Tubules

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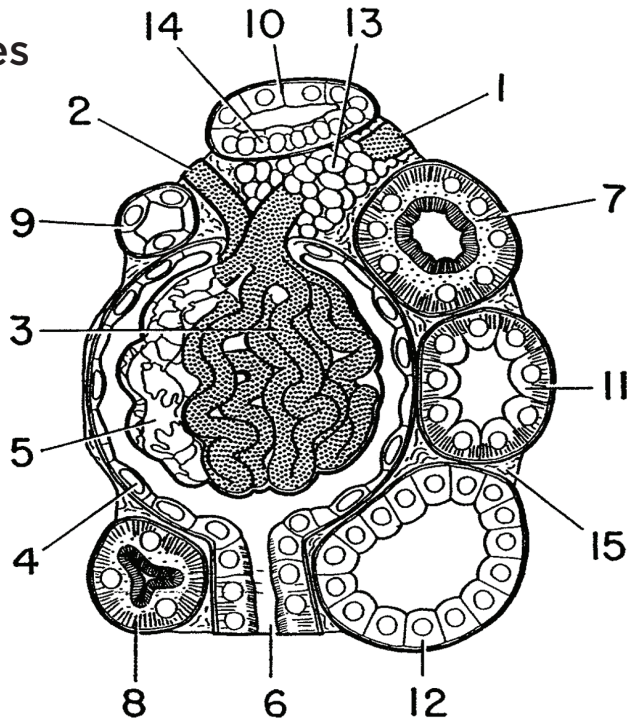

1. Afferent glomerular arteriole.
2. Efferent glomerular arteriole.
3. Capillary loops of glomerulus.
4. Parietal epithelium of Bowman's capsule.
5. Visceral epithelium of Bowman's capsule.
6. Neck of tubule.
7. Proximal convolution.
8. Descending thick limb of Henle's loop.
9. Thin segment of Henle's loop.
10. Ascending thick limb of Henle's loop, at point of contact with afferent glomerular arteriole.
11. Distal convolution.
12. Collecting tubule.
13. Juxtaglomerular apparatus (Polkissen).
14. Macula densa.
15. Connective tissue.

All elements of the kidney are bound together by connective tissue. Except for the ascending limb of Henle's loop (10), the arrangement of the tubules around the glomerulus is arbitrary on the model, and not likely to occur in nature. The glomerulus has been simplified for clarity. The afferent arteriole usually penetrates some distance into the glomerulus before breaking up into about 50 capillary loops. The glomerulus contains a central core of connective tissue (not shown on the model), which is divided into several lobes. The capillaries pass as individual loops over the surface of the glomerulus toward its lower pole, then turn inward, and pass for at least part of their length through the connective tissue core, before anastomosing to form the efferent arteriole. The visceral epithelium closely invests the capillary loops, and dips down between the lobes of the glomerulus. The visceral epithelial cells may have polygonal or serrated outlines, or complexly interdigitating borders. All three types of cells may occur on a single capillary loop. The parietal capsular epithelium is of the simple squamous type. A basement membrane is well defined in both glomerulus and tubules.

The proximal convolution and descending thick limb of Henle's loop are lined by cuboidal cells with brush borders. Their basal half contains rod-like mitochondria, and intercellular boundaries are indistinct. The lumen of the tubule may be either expanded or collapsed, according to the state of activity. The thin segment of Henle's loop is lined by flattened cells whose nuclei bulge into the lumen. The thick ascending limb has somewhat granular cuboidal cells. Where it contacts the afferent arteriole, a dense patch of nuclei, the macula densa, occurs on the side facing the artery. The distal convolution is composed of cells showing basal striations, like those of the proximal convolution, but lacking the brush border. Their free surfaces bulge into the lumen, and their intercellular boundaries are distinct. The collecting tubule, for most of its length, is lined with clear cuboidal cells, but near the lower end, in the papillary duct, the epithelium becomes columnar.

The juxtaglomerular apparatus represents modified cells of the smooth muscle coat of the afferent arteriole. Their cytoplasm varies in different animals from granular to epithelioid. They are not universally present, even in the same species, and appear to be better developed in the outer glomeruli than in the inner. They are in contact with the macula densa of their own loop. Little is known of the function of these two structures. It has been conjectured that they may in some way regulate blood pressure within the glomerulus in response to changes in the urine produced by the particular nephron. It is also suggested that the juxtaglomerular apparatus may be an endocrine gland, producing the substance renin, through which the kidney exerts a profound effect upon blood pressure.

REFERENCES

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