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1.Renal function of desert dwellers and the anatomical bassist of their unique adaptation.

Desert mammals do not readily find water, hence they must excrete very little amount of water. They are also able to produce highly concentrated urine and their renal system is adapted for this function.

Desert dwellers have long nlops of henle (ascending and descending limbs of nephron loops) which go deep down into the medulla and shorter renal tubules (proximal and distal renal tubules). As a result, desert dwellers have a thicker renal medulla than other mammals.The nephron loops along with counter flowing blood vessels called vasa recta, help in water conservation

Blood first flow along ascending limb is nephron loop,which is impermeable to water. Solutes can leave the filtrate and enter the blood along this stretch. When this blood flows along the descending limbs, water is reabsorbed from the filtrate but not the solutes. The longer the nephron loops, more amount of solute will be reabsorbed and hence more amount of water can be removed from the filtrate.

2. To produce urine, nephrins and collecting ducts perform three basic process-glomerular filtration, tubular reabsorption and tubular secretion. In the first step of urine production, water and most solutes in the blood plasma move across the wall of glomerular capillaries, where they are filtered and move into the glomerular capsule and then into the renal tubules.

The fluid that enters the capsular space is called the glomerular filtrate. The fraction of blood plasma in the af erent arterioles of the kidneys that becomes glomerular filtrate is the filtration frac-tion. Although a filtration fraction of 0.16–0.20 (16–20%) is typical, the value varies considerably in both health and disease. On average, the daily volume of glomerular filtrate in adults is 150 liters in females and 180 liters in males. More than 99% of the glomerular filtrate returns to the bloodstream via tubular reabsorption, so only 1–2 liters (about 1–2 qt) is excreted as urine.

**The Filtration Membrane (Glomerular filtration barrier)**

Together, the glomerular capillaries and the podocytes, which completely encircle the capillaries, form a leaky barrier known as the filtration (endothelial–capsular) membrane. This sandwichlike assembly permits filtration of water and small solutes but prevents filtration of most plasma proteins and blood cells. Substances filtered from the blood cross three filtration barriers—a glomerular endothelial cell, the basement membrane, and a filtration slit formed by a podocyte.

1 Glomerular endothelial cells are quite leaky because they have large fenestrations (pores) that measure 0.07–0.1 um in diameter. This size permits all solutes in blood plasma to exit glomerular capillaries but prevents filtration of blood cells. Located among the glomerular capillaries and in the clef between afferent and efferent arterioles are mesangial cells. These contractile cells help regulate glomerular filtration.

2 The basement membrane, a layer of acellular material between the endothelium and the podocytes, consists of minute collagen fibers and negatively charged glycoproteins. The pores within the basement membrane allow water and most small solutes to pass through. However, the negative charges of the glycoproteins repel plasma proteins, most of which are anionic; the repulsion hinders filtration of these proteins.

3 Extending from each podocyte are thousands of footlike processes termed pedicels ( little feet) that wrap around glomerular capillaries. The spaces between pedicels are the filtration slits. A thin membrane, the slit membrane, extends across each filtration slit; it permits the passage of molecules having a diameter smaller than 0.006–0.007 um, including water, glucose, vitamins, amino acids, very small plasma proteins, ammonia, urea, and ions. Less than 1% of albumin, the most plentiful plasma protein, passes the slit membrane because, with a diameter of 0.007 𝜇m, it is slightly too big to get through.

The principle of filtration—the use of pressure to force fluids and solutes through a membrane—is the same in glomerular capillaries as in blood capillaries elsewhere in the body . However, the volume of fluid filtered by the renal corpuscle is much larger than in other blood capillaries of the body for three reasons:

1. Glomerular capillaries present a large surface area for filtration be-cause they are long and extensive. Mesangial cells regulate how much surface area is available. When mesangial cells are relaxed, surface area is maximal, and glomerular filtration is very high. Contraction of mesangial cells reduces the available surface area, and glomerular filtration decreases.

2. The filtration membrane is thin and porous. Despite having several layers, the thickness of the filtration membrane is only 0.1 mm. Glomerular capillaries also are about 50 times leakier than blood capillaries in most other tissues, mainly because of their large fenestrations.

3. Glomerular capillary blood pressure is high. Because the ef erent arteriole is smaller in diameter than the af erent arteriole, resistance to the outflow of blood from the glomerulus is high. As a result, blood pressure in glomerular capillaries is considerably higher than in blood capillaries elsewhere in the body.