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Assignment of Urinary system

Answer

1) Renal function of desert dwellers and anatomical basis of their unique adaptation

 Desert dwellers are those animals that live in the desert (an area of land with desolate terrain and with little water or vegetation. These animals include camel, desert rodents and Kangaroo rats etc.

 The **renal function** of these animals differs from other animals that live in the environment with enough water. The nephrons (the functional unit of the kidney) in desert mammal Camel are equipped with well-developed Henle's loop and number of **juxtamedullary nephrons; those nephrons that possess long loops of henle and penetrate deeply in the medulla**, in kidneys is very high, about 35% (in man this number is about 15%). This is due to the fact that they don’t take water often so therefore, they tend to secrete **highly** **concentrated urine**.

 **Anatomically**, due to the situation of their environment, these desert dwellers are able to adapt as they possess **thicker medulla** and due to the high number of nephrons; **juxtamedullary nephrons** they have. They get little water from their environment, so because of the long loop of henle they possess in their juxtamedullary nephrons, the urine to be excreted tends to get concentrated overtime in the loop resulting in removing very little water from the system and along with counter flowing blood vessels, called vasa recta, help in conservation of water.

 Blood first flows along ascending limb of Henle, which is impermeable to water. Solutes can leave the filtrate and enter the blood along this stretch. When this blood flows along descending limb, water is reabsorbed from filtrate but not the solutes. Longer the Henle's loop, more amount of solute will be reabsorbed and hence more amount of water could be removed from filtrate.

2) Clinical importance of the glomerular filtration barrier

 The glomerular filtration barrier consists of three layered components: the fenestrated capillary endothelium, the glomerular basement membrane, and filtration slits between podocyte processes. The major component of the filter is formed by fusion of the basal laminae of a podocyte and a capillary endothelial cell. The clinical importance of this barrier includes;

 1) In diseases such as diabetes mellitus and glomerulonephritis, the glomerular filter is altered and becomes much more permeable to proteins, with the subsequent release of protein into the urine (proteinuria). Proteinuria is an indicator of many potential kidney disorders.

 2) Glomerular capillaries are uniquely situated between two arterioles—afferent and efferent—the muscle of which allows increased hydrostatic pressure in these vessels, favoring movement of plasma across the glomerular filter.

3) In addition to capillary endothelial cells and podocytes, renal corpuscles also contain mesangial cells (Gr. mesos, in the midst, + angeion, vessel), which resemble pericytes in producing components of an enveloping external lamina. Mesangial cells are difficult to distinguish in routine sections form podocytes, but often stain more darkly. They and their surrounding matrix comprise the mesangium, which fills interstices between capillaries that lack podocytes.

Functions of the mesangium

a) Physical support and contraction—the mesangium provides internal structural support to the glomerulus and like pericytes, its cells respond to vasoactive substances to help maintain hydrostatic pressure for the optimal rate of filtration.

b) Phagocytosis—mesangial cells phagocytose protein aggregates that adhere to the glomerular filter, including antibody-antigen complexes abundant in many pathological conditions.

c) Secretion—the cells synthesize and secrete several cytokines, prostaglandins, and other factors important for immune defense and repair in the glomerulus.