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Department: Anatomy

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Questions:

- **Critically examine the renal function of desert dwellers and the anatomical basis of their unique adaptation.**

Desert mammals do not readily find water which makes them excrete very little amount of highly concentrated urine. The henle's loop of juxtamedullary nephrons with the vasa recta are responsible for the conservation of the little water they take in whenever they get. The renin-angiostensin-aldosterone system is very active, retaining sodium ion with water. The urine is concentrated at the expense of other electrolytes. Both the renal blood and urinary flow rates are lower than in species that have access to unlimited water supply. The renal medulla is responsible for maintenance of water balance. The nephrons and vessels interact with each other, exchanging water and solutes among many compartments in an arranged manner in order to produce urine that is concentrated in solutes.

Desert animals can retain water by avoiding the sun and extreme heat. This makes them avoid drinking water and avoid water loss through the body. Water is often used up in the cooling process, hence making them dehydrated. Nocturnal desert animals keep cool by being active at night, while others get away from the sun's heat by digging underground burrows.

The henle's loop is usually longer in desert animals because they need to conserve water for survival so they want to pass out urine once in a while and in very small quantities.

- **Write extensively on the clinical importance of the glomerular filtration barrier.**

The glomerular filtration barrier is a highly specialised blood filtration interface that displays a high conductance to small and mid sized solutes in plasma but retains relative impermeability to macromolecules. In health, the glomerular filtration barrier functions as a highly organised, semipermeable membrane preventing the passage of the majority of proteins into the urine. This barrier is composed of the glomerular basement membrane, the podocyte, and the slit diaphragm between the podocytes.

The glomerular filtration barrier has several layers.11 The first is a glycocalyx made up of proteoglycans and an adsorbed layer of plasma proteins that is located between the endothelial cells and the capillary lumen. Fenestrated endothelial cells form the next layer. Next is the thick glomerular basement membrane (GBM), which is synthesized by podocytes and endothelial cells and has an inner layer composed of collagen type IV and laminin sandwiched between layers of heparin sulfate. Podocyte foot processes line the epithelial side of the GBM; the intercellular junctions between adjacent foot processes are closed by the slit diaphragm, a specialized intercellular junction that acts

as a molecular sieve and the final component of the filtration barrier. The slit diaphragm comprises several proteins, including nephron, CD-associated protein (CD2AP), podocin, the tight junction protein ZO-1 (zonula occludens 1),P-cadherin, catenins, and the calcium Chanel TRPC6 (transient receptor potential cation channel, subfamily C, member 6), each of which is required for slit diaphragm integrity. Slit diaphragm proteins are supported by the highly dynamic podocyte actin cytoskeleton that in turn is anchored to an complex that fastens each podocyte foot process to the GBM.