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**COLLEGE:** MEDICINE AND HEALTH SCIENCES.

**DEPERTMENT:** ANATOMY.

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ASSIGNMENT.

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

2. Write extensively on the clinical importance of the glomerular filtration barrier

ANSWER.

1.The nephrons in desert mammal Camel are equipped with well developed Henle's loop and number of juxtamedullary nephrons in kidneys is very high, about 35% (in man this number is about 15%).

Desert mammals do not readily find water, hence they must excrete very less amount of water. They are able to produce highly concentrated urine. The Henle's loop of juxtamedullary {adjacent to medulla of kidney} nephron goes deep down into the medulla. This is why medulla of camel's kidney is thicker than that of other mammals, but it is most well developed in another desert mammal, the kangaroo rats.

The Henle's loops of juxtamedullary nephrons 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. The glomerular barrier is composed of three basic layers which separate blood from Bowman's Space. The first layer is that of glomerular capillary endothelial cells which are fenestrated, allowing for high fluid permeability. The second layer is that of the glomerular

basement membrane which invests the fenestrated endothelial cells. The third layer is that of podocytes, a specialized type of epithelial cells with foot like processes that support the glomerular basement membrane. The glomerular capillaries display an enormous permeability to water and small molecules far beyond that of most other capillary beds. The physical basis of this incredible permeability is the fenestrated nature of the glomerular endothelium which facilitates molecular transport across the glomerular capillaries.  
The glomerular barrier allows for large volumes of fluid filtration into bowman's space but also exerts some selectivity on the molecules that are allowed to cross. The barrier itself is composed of fenestrated capillaries invested by the glomerular basement membrane (GBM). Although highly permeable to water and small solutes, the glomerular barrier is also highly selective and prevents the passage of nearly all plasma proteins and cells. Studies have shown that the glomerular barrier selects for two basic molecular features: size and charge. As the molecular weight of a molecule increases, its capacity for filtration progressively and rapidly declines. Furthermore, for any given sized molecules, its capacity for filtration progressively and rapidly declines as its charge becomes more negative. Because plasma proteins are typically large and negatively charged, they are almost totally prevented from crossing the glomerular barrier.

**Physical Basis** The physical basis for the size and charge selectivity of glomerular filtration is that of the glomerular basement membrane and its supporting podocytes, although the basement membrane appears to be most important. The glomerular basement membrane is a tight meshwork of negatively charged glycoproteins. This meshwork not only provides a physical barrier to large molecules, its negative charge repels other negatively-charged molecules. Podocyte foot processes also appear to display a strong negative charge which enhances the repulsive power of the basement membrane.