NAME- ADEGBOLA OLUWASEUN ADEKUNLE

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COURSE- ANA 204

DEPARMENT- MEDICAL LAB SCIENCE

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.

1. Desert habitat is home to a variety of animals that have adapted to survive in harsh, dry conditions. Some of the most iconic desert animals have obvious physical characteristics that have enabled them to adapt to their environment some of the animals are:

- Camel's

They are one of the most noteworthy desert dwellers. The large humps on camel's backs are key to their survival. The Bactrian camel has two humps on its back while the dromedary camel has only one. Both types of camel store fat in these humps that can be broken down over time. During long journeys the camel uses the stored fat for energy and water and can go for long periods of time without other sustenance. Their wide, thick-soled feet enable them to walk on the hot sand. Distinctive thick eyebrows and long eyelashes protect their eyes from sand and the harsh Ray's of the sun. 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 kidney is able to concentrate urine, thereby reducing water loss in the summer when the diet produces very little water.

- Gerbils

Have several characteristics that have allowed them to adapt to dry environments. Gerbils have an excellent ability for thermoregulation, and have a high level of heat tolerance. They have a unique water metabolism in that they require very little water to function. Gerbils can obtain sufficient water from their diet and their kidney have a highly efficient urine concentrating capacity to ensure adequate hydration. The ratio of long-loop nephrons to short-loop nephrons in gerbils is high. Ninety-six percent of their nephrons are long loop which allows them to efficiently concentrate their urine. The digestive system is also very efficient at absorbing and retaining water and water can be

stored in fat cell layers. Gerbils produce and excrete a small amount of concentrated urine and dry faeces per day.

- Dipodomy

They are true dessert animals and have an incredible water conservation system. This system allows the rats to gain most of their water supply from their diet. Williams (1980) states that the kangaroo rats rarely drink water if freely accessible, but in 2002, “Domelly and Quimby” contend that these animals will drink water readily if offered in captivity. Kangaroo rats have external cheek pouches to store food and long tails prone to degloving injury if restrained, and they must have access to dust baths to maintain a healthy fur coat.

Some desert animals can endure greater dehydration than humans; a camel, for example may lose water amounting to 30% of its body weight without serious consequences. Only sweat that evaporates is useful in cooling the skin. Sweat that rolls off or is wiped off does not provide significant cooling. Nevertheless, excess sweat does ensure full wetting of the skin. The amount of sweat that evaporates from the skin demands on ambient temperature, humidity and air velocity. Evaporative cooling is most efficient in a hot, dry, windy environment.

Many desert animals are able to use available water opportunistically by drinking large quantities in short time. This ability is proverbial in the camel that can take up to 30% of its body weight in a few minutes. Camels and other desert mammals have resistant blood cells that can withstand osmotic imbalance.

2. The glomerular filtration barrier is a highly specialized blood filtration interface that displays a high conductance to small and midsized solutes in plasma but retains relative impermeability to macromolecules. Its integrity is maintained by physicochemical and signaling interplay among its three core constituents — the glomerular endothelial cell, the basement membrane and visceral epithelial cell (podocyte). The glomerular filtration barrier determines the composition of the plasma ultra filtrate. It restricts the filtration of molecules primarily on the basis of size.In the clinic, A reduction in GFR in disease states is most often due to decreases in the ultrafiltration coefficient (Kf) because of the loss of filtration surface area.