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

### Genitourinary System

Since they are desert animals, gerbils have several characteristics that have allowed them to adapt to dry environments. Gerbils have an excellent ability for [thermoregulation](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/thermoregulation" \o "Learn more about Thermoregulation from ScienceDirect's AI-generated Topic Pages), and they have a high level of heat tolerance. They have a unique water metabolism in that they require very little water to function (Winkelmann and Getz, 1962). Gerbils can obtain sufficient water from their diet and their kidneys have a highly efficient [urine-concentrating capacity](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/kidney-concentrating-capacity" \o "Learn more about Kidney Concentrating Capacity from ScienceDirect's AI-generated Topic Pages) 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](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/digestive-system" \o "Learn more about Digestive System from ScienceDirect's AI-generated Topic Pages) 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 feces per day (Alderton, 1986); therefore they require less frequent cage changing than other laboratory rodent.**Ever wondered what the camel does differently than us to survive in the hot environment?**The camel does have a special kidney and a special GI tract.The camel's kidney actually can concentrate the urine more than sea water but less than a dessert rat.  Since the camel can concentrate the urine more than sea water, salty water intake won't harm the animal. Investigators have studied the  structure of the camelian kidney to discover whether or not the anatomical features necessary for producing a highly concentrated urine were present or not. The relative thickness of the medulla was calculated in the camelian kidney as it has been demonstrated that this thickness has a direct relationship with the ability to produce a highly concentrated urine.  A relative thickness of the medulla is a good measure of the length of the loop of Henle which is an indicator of urine concentration. The thickness reported in camels was 7.89 in comparison to the value of 8.5 in kangaroo rats, much more than humans.  
Also, what happens if you haven't drunk water in 5 days and all of a sudden you re hydrate. A dehydrated camel can replace water within minutes of drinking, and some of this water is quickly absorbed into the bloodstream. With water in the bloodstream, ADH declines and the kidney will return to normal renal function within 30 minutes of drinking. Not only does the camel adopt to scarce water but the kidney can also adopt to rapid dehydration and not lead to demylination of the brain.evolution the ‘ship of the desert’ has developed several

mechanisms for making life in a very harsh climate possible. The

combination of these mechanisms is without comparative anatomical

homology of any other domesticated animal. Different anatomical

adaptations in camel are which help the camel survive in deseart area. The

hump, head, neck nostrils, eye, poll gland, skin coat, limbs, urinary system,

digestive system and circulatory system are the different structural

adaptation in camel.

The head of the camel is small in comparison to that of other domestic

animals. It bears no horns. The camel has a long arched neck helping him to

manipulate the high tree plants and to explore the enemy from long

distances. Camel mouths has a thick leathery lining, allowing them to chew

thorny desert plants. The upper lip is split and hairy, extensible and slightly

prehensile it is very sensitive. This modification help the camel to select its

food (selective feeding) and avoid the thorny plants. Camels are browsing

animals, they feed on thorny plants of the desert. Anatomical adaptation as

the mobile and prehensive split upper lip enable them to avoid the injuries of

the desert plants, the camel jaw and dental pad enable it to seize and tear

branches off trees if required, and with slow lateral movements of the jaw,

the thorns of these plants are destructed. Also a small but mobile tongue with

numerous hard, dentigerous papillae protruding from the lining of the cheeks

and lateral aspect of the tongue assist in the mastication and ingestion of

food. The esophagus has a large potential diameter with many mucus

secreting glands. They are opharyngeal and oesophageal anatomy assist in

the movement of hard materials without causing irritation to mucosa.

Camels' mouths have a thick leathery lining, allowing them to chew thorny

desert plants. The nostrils of the camel are long slit- like appearance having

wing so the camel is the only animal who can close its nostril as protection

against sand and winds’ when the camel exhales, water vapor becomes

trapped in their nostrils and is reabsorbed into the body as a means to

conserve water. Small bluntly erected ears to hear the minimal sound

vibration and hear for long distance in the desert. The ear contains small

hairs to filter and warm the air entered the ears in sandy environment. The

poll glands which are situated towards the top of the back of the neck behind

ears. It is more active under condition of heat and fatigue than that at any

other time except when the male is in rut, so it act as modified sweat gland to

help in the evaporation. Hump is rounded mass or protuberance, such as

fleshy structure on the back of the camel. The hump composed of the

adipose tissue which contain white fat. It act as food (fat) storage which will

be converted to energy and water in case of starvation in the desert.

The orbit of the one-humped camel was circular, equidistant, completely

osseous and markedly projecting laterally. The upper eyelid had long cilia

and tuft of long cilia was situated dorsal to the medial canthus. The cilia of

the lower eyelid were short and they gradually disappeared towards the

lateral cantus. The eyes are large and prominent enable the camel to see in

different directions and for long distances. The massive supra orbital fossa or

processes give some protection with the long lashes against the sandy

environment of the desert in windy day. If sand gets lodged in their eyes,

they can dislodge it using their transparent third eyelid. Long eyelashes form

a barrier against sand

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

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 signalling interplay among its three core constituents—the glomerular endothelial cell, the basement membrane and visceral epithelial cell (podocyte). Understanding the pathomechanisms of inherited and acquired human diseases as well as experimental injury models of this barrier have helped to unravel this interdependence. Key among the consequences of interference with the integrity of the glomerular filtration barrier is the appearance of significant amounts of proteins in the urine. Proteinuria correlates with kidney disease progression and cardiovascular mortality. With specific reference to proteinuria in human and animal disease phenotypes, the following review explores the roles of the endothelial cell, glomerular basement membrane, and the podocyte and attempts to highlight examples of essential crosstalk within this barrier.

Glomerular Filtration Barrier The [glomerular filtration barrier](https://www.sciencedirect.com/topics/medicine-and-dentistry/glomerular-filtration-barrier" \o "Learn more about Glomerular Filtration Barrier from ScienceDirect's AI-generated Topic Pages) has several layers.11 The first is a [glycocalyx](https://www.sciencedirect.com/topics/medicine-and-dentistry/glycocalyx" \o "Learn more about Glycocalyx from ScienceDirect's AI-generated Topic Pages) made up of [proteoglycans](https://www.sciencedirect.com/topics/medicine-and-dentistry/proteoglycan" \o "Learn more about Proteoglycan from ScienceDirect's AI-generated Topic Pages) and an adsorbed layer of [plasma proteins](https://www.sciencedirect.com/topics/medicine-and-dentistry/blood-proteins" \o "Learn more about Blood Proteins from ScienceDirect's AI-generated Topic Pages) that is located between the [endothelial cells](https://www.sciencedirect.com/topics/medicine-and-dentistry/endothelial-cell" \o "Learn more about Endothelial Cell from ScienceDirect's AI-generated Topic Pages) and the capillary lumen. Fenestrated endothelial cells form the next layer. Next is the thick [glomerular basement membrane](https://www.sciencedirect.com/topics/medicine-and-dentistry/glomerulus-basement-membrane" \o "Learn more about Glomerulus Basement Membrane from ScienceDirect's AI-generated Topic Pages) (GBM), which is synthesized by [podocytes](https://www.sciencedirect.com/topics/medicine-and-dentistry/podocyte" \o "Learn more about Podocyte from ScienceDirect's AI-generated Topic Pages) and endothelial cells and has an inner layer composed of [collagen type IV](https://www.sciencedirect.com/topics/medicine-and-dentistry/collagen-type-4" \o "Learn more about Collagen Type 4 from ScienceDirect's AI-generated Topic Pages) and [laminin](https://www.sciencedirect.com/topics/medicine-and-dentistry/laminin" \o "Learn more about Laminin from ScienceDirect's AI-generated Topic Pages) sandwiched between layers of heparin sulfate. Podocyte foot processes line the epithelial side of the GBM; the [intercellular junctions](https://www.sciencedirect.com/topics/medicine-and-dentistry/cell-junction" \o "Learn more about Cell Junction from ScienceDirect's AI-generated Topic Pages) 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 [nephrin](https://www.sciencedirect.com/topics/medicine-and-dentistry/nephrin" \o "Learn more about Nephrin from ScienceDirect's AI-generated Topic Pages), CD-associated protein (CD2AP), [podocin](https://www.sciencedirect.com/topics/medicine-and-dentistry/podocin" \o "Learn more about Podocin from ScienceDirect's AI-generated Topic Pages), the [tight junction protein ZO-1](https://www.sciencedirect.com/topics/medicine-and-dentistry/protein-zo1" \o "Learn more about Protein ZO1 from ScienceDirect's AI-generated Topic Pages) (zonula occludens 1), [P-cadherin](https://www.sciencedirect.com/topics/medicine-and-dentistry/p-cadherin" \o "Learn more about P Cadherin from ScienceDirect's AI-generated Topic Pages), [catenins](https://www.sciencedirect.com/topics/medicine-and-dentistry/catenin" \o "Learn more about Catenin from ScienceDirect's AI-generated Topic Pages), and the [calcium channel](https://www.sciencedirect.com/topics/medicine-and-dentistry/calcium-channel" \o "Learn more about Calcium Channel from ScienceDirect's AI-generated Topic Pages) [TRPC6](https://www.sciencedirect.com/topics/medicine-and-dentistry/trpc6" \o "Learn more about TRPC6 from ScienceDirect's AI-generated Topic Pages) (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](https://www.sciencedirect.com/topics/medicine-and-dentistry/podocyte" \o "Learn more about Podocyte from ScienceDirect's AI-generated Topic Pages) [actin](https://www.sciencedirect.com/topics/medicine-and-dentistry/actin" \o "Learn more about Actin from ScienceDirect's AI-generated Topic Pages) [cytoskeleton](https://www.sciencedirect.com/topics/medicine-and-dentistry/cytoskeleton" \o "Learn more about Cytoskeleton from ScienceDirect's AI-generated Topic Pages) that in turn is anchored to an [integrin](https://www.sciencedirect.com/topics/medicine-and-dentistry/integrin" \o "Learn more about Integrin from ScienceDirect's AI-generated Topic Pages) complex that fastens each podocyte foot process to the GBM.The [glomerular filtration barrier](https://www.sciencedirect.com/topics/immunology-and-microbiology/glomerular-filtration-barrier" \o "Learn more about Glomerular Filtration Barrier from ScienceDirect's AI-generated Topic Pages) consists of the fenestrated [endothelium](https://www.sciencedirect.com/topics/immunology-and-microbiology/endothelium" \o "Learn more about Endothelium from ScienceDirect's AI-generated Topic Pages), the [glomerular basement membrane](https://www.sciencedirect.com/topics/immunology-and-microbiology/glomerulus-basement-membrane" \o "Learn more about Glomerulus Basement Membrane from ScienceDirect's AI-generated Topic Pages), and the podocyte foot processes, which are connected by a slit-diaphragm. The filtration barrier normally acts to retain protein inside the lumen of the capillaries separate from the urinary space; however, defects in the [podocytes](https://www.sciencedirect.com/topics/immunology-and-microbiology/podocyte" \o "Learn more about Podocyte from ScienceDirect's AI-generated Topic Pages) affecting the feet, tight junction (podocin, nephrin), and the slit diaphragm signaling, actin [cytoskeleton](https://www.sciencedirect.com/topics/immunology-and-microbiology/cytoskeleton" \o "Learn more about Cytoskeleton from ScienceDirect's AI-generated Topic Pages), and cell matrix interactions have been identified in causing a breakdown of this barrier.16