

PHYSIOLOGY OF OSMOREGULATION IN VERTEBRATES

Q. Define osmoregulation.

Osmoregulation is the active regulation of the osmotic pressure of an organism's body fluids, detected by osmoreceptors, to maintain the homeostasis of the organism's water content; that is, it maintains the fluid balance and the concentration of electrolytes (salts in solution) to keep the fluids from becoming too diluted or concentrated. Hober (1902) defined the term as the collective activity of the variety of mechanisms used by organisms to control water movement and water volumes in the body.

Q. List out the possible problems faced by animals in the regulation of the electrolytes and water of the tissues.

i) Ionic regulation in isoosmotic media, ii) Maintenance of a hyper osmotic state, iii) Maintenance of a hypoosmotic state, iv) Terrestrial living. All these problems pose characteristic adaptations among animals.

Q. What do you mean by stenohaline and euryhaline fishes?

Serial num	Stenohaline	Euryhaline
1	Fishes that live only within narrow range of outside salinities are said to be stenohaline.	Fishes are able to withstand a wide range of salinities either by osmoconformity (osmoconformers) or by osmoregulation.
2	Majority of fishes both marine and fresh-water. e.g goldfish (<i>Carassius auratus</i>)	salmon, eels.

Q. Define osmoconformer and osmoregulator.

Serial number	Osmoregulator	Osmoconformer
1	Animals those maintain or regulate osmotic concentration of body fluid in spite of external concentration changes.	Animals those change the osmotic concentration of body fluids to conform with that of the medium.
2	Elasmobranch, teleost	Some craniates as well are osmoconformers, notably sharks, skates, and hagfish.

Most marine invertebrates, on the other hand, may be isotonic with sea water (osmoconformers). Their body fluid concentrations conform to changes in seawater concentration. Cartilaginous fishes' salt composition of the blood is similar to bony fishes; however, the blood of sharks contains the organic compounds urea and trimethylamine oxide (TMAO). This does not mean that their electrolyte composition is similar to that of sea water. They achieve isotonicity with the sea by storing large concentrations of urea. These animals that secrete urea are called ureotelic animals. TMAO stabilizes proteins in the presence of high urea levels, preventing the disruption of peptide bonds that would occur in other animals exposed to similar levels of urea. Sharks are cartilaginous fish with a rectal gland to secrete salt and assist in osmoregulation.

Q. Describe different mode of osmoregulatory adaptations in fishes.

Marine water fish		
Serial number	Type I	Type II
1	Whose osmotic concentration is the same as or slightly above sea water	Whose osmotic concentrations are about one third of that of sea water
2	This group has no major problem of water balance, because its inside and outside concentrations are equal, there is no osmotic water flow.	They live in constant danger of losing water to the osmotically more concentrated medium
3	Hag fish, elasmobranch etc	Lampreys, teleosts etc

Fresh water fish

The freshwater fishes have internal concentrations greater than that of their external medium. Thus they are hyperosmotic to the medium. Therefore, the osmotic problem and the means to solve them differ among fishes of different habitats.