Ionic Pumps and hormones for ionic and osmotic regulation

- **During ionic regulation organism need active transport of ions either inward or outward. For which there are various pumps available such Na, K, Cl, Mg, Ca. Na pump is most studied.**
- **Whenever Na+ accumulates inside tissue & K+ outside tissue it stimulates Na+ pump. It activates enzyme of ATPase & energy is used for elimination of Na+. Oxygen consumption also increases. In absence of Mg++ Na-pump can not work. Normally in this pump Na+ is exchanged with K+ or H+ or NH4+. Cl- is exchanged with HCO3-.**

- **Like Na-pump, Cl-pump is studied in frog .**
- **K-pump is studied in Cercapia. It is also established that Ca++ions are important in ionic & osmotic regulation as they govern permeability of membranes.**

Hormones play important role in regulation of different pumps

- **The animals produce diuretic hormones which affect membranes and prevent salt loss and increase water loss.**

- **In case of Earthworm the diuretic hormone is secreted by brain cells.**

- **In Pulmonate snails – green cells of pleural ganglion secrete diuretic hormone.**

- **In insects the hormones are secreted by Thoracic ganglion.**
- **In Rhodnius bug, when fully fed, crop is full of blood. Due to this pressure is developed on thoracic ganglion, it secretes diuretic hormones & excess of water is removed.**
- **In case of higher animals pituitary secretes the diuretic hormones. These hormones have favourable effect on gills, salt gland & general body surface.**

- **Antidiuretic hormones (ADH)**
- **They are secreted in earthworm by brain cell.**
- **In snails secreted by green cells of pleural ganglion or yellow cells.**
- **In insects the hormones are secreted by Thoracic ganglion.**
- **Desert mammals need more hormone for regulation of water and salts, hence pituitory is larger in size,**

- **Prolactin, a pituitary hormone, affects the cells of Gills , Skin, Kidney and prevents salt loss in fresh water.**
- **Fish Fundulus when kept in dilute sea water or in fresh water can survive. But if the pituitory is removed it can not survive in fresh water. But in such fish, if the pituitory extract is injected it survives. Thus the prolactin secreted by pituitory plays an important role in ionic & osmotic regulation.**
- **Stickleback lives in fresh water during summer & in marine water during winter & when it is in fresh water in prolactin secretion rises.**

- **Adrenal cortex hormones are also important for fresh water living or marine water living. In marine water it causes excretion of salts through gills / excretory surfaces. In fresh water living there is absorption of salt as and when required.**
- **Adreno cortico steroid Aldosteron secreted by adrenal cortex is responsible for ionic regulation**
- **If adrenal cortex is removed it causes loss of Na, Cl & water & retention of potassium.**
- **Thus aldosteron governs absorption of Na, Cl & water & excretion of 'K'.**
- **It not only affects kidney but also sweat gland, salivary gland & intestine & is present in amphibians, reptiles, birds & mammals.**

- **Renin – Angiotensin system is highly evolved in mammalian kidney & it regulates Na, Cl & blood pressure etc. The hormone system is controlled by Juxta Glomerular apparatus in kidney.**

- **Thyroid hormones decrease actively in hypoosmotic regulation & rise in hyperosmotic regulation. They play important role in ionic and osmotic regulation in all animals including terrestrial.**

- **Apart from these adrenaline & also insulin have effect on ionic or electrolyte regulation.**