

Physiological Adaptation to Terrestrial Environment

Introduction → Physiological adaptation refers to the adaptations that an organism undergoes in the functions performed by their respective organs. They are equally important as structural ones and both can not be separated from each other.

The Terrestrial habitat includes:-

- ① Curatorial
- ② fossorial
- ③ Stansorial (Arboreal)
- ④ volant (aerial)
- ⑤ cave
- ⑥ Desert adapⁿ

We are here dealing only with the physiological adaptation in all the terrestrial habitat. It basically includes the following adaptation:-

1) Homeostasis:- It refers to the maintenance of the body fluids level of electrolyte, dissolved gases in body fluids, pH & so on. The whole maintenance of the internal environment is known as Homeostasis. Homeostatic Control refers to a balance between input and out-put as for ex:- in a thermoregulatory system. It is a balance between heat gain and heat loss. It is a best example of physiological adaptation. Other ex. of homeostasis in terrestrial vertebrates is our ability to respire in order to bring down body temperature which tends to increase or decrease in Cardial output when aerial pressure increases.

2) Adaptation of Mammals to high altitude → At high altitudes the total pressure of atmosphere diminishes rapidly with increasing altitude but the composition of air remains the same apart from water vapour remain same. So the p_{O_2} (partial pressure) must fall.

As the p_{O_2} on high altitude

is low, a person at high altitudes suffers only with hypoxia or low. Hypoxia is dangerous because:-

- a) Respiratory Mechanism will not allow breathing to increase as necessary to cope with hypoxia.
- b) Secondly, a variety of other changes in circulation & blood tend to ~~increase~~ decrease O_2 supply to tissues over days and weeks and leads to hypoxia.

The changes in breathing and circulation that develop in time are known as acclimatization. This tends to cause respiratory changes and circulatory changes.

Respiratory changes:- A reduction in the PO_2 of air results in a decrease in a blood PO_2 which causes an increase in lung ventilation in mammals. The rise in lung ventilation then leads to an increase in CO_2 elimination and decrease in blood PCO_2 , and therefore an increase in pH of the CSF (Cerebrospinal fluid).

Circulatory changes:- The response to hypoxia also involves effects of CO_2 on carotid and aortic bodies. Low oxygen levels cause a local vasoconstriction* in the pulmonary capillaries in mammals producing a rise in pulmonary arterial blood pressure.

3) **Respiratory Systems** → Basically the respiratory organs in terrestrial environment are lungs but particularly in case of volant or flying animals, it undergoes adaptation, as the respiratory system is highly developed. The complicated lungs are supplemented by system of air sacs which reduce specific gravity to facilitate complete aeration to the lungs & to help in regulating body temperature by internal respiration.

4) **Food Habitat and Digestive System** → In terrestrial animals digestive

system contain enzymes but in case of flying animals especially in bird state of food requirement and digestion is high. Rectum is much reduced & never stores undigested food because flying animal can not bear it. Another very important food habit adaptation in desert animals is that their food has high fat content because food on oxidation gives more water (H_2O) by which they continue their survival in that environment.

- 5) Excretory System: → The excretion particularly in birds, reptiles and terrestrial insects is in the form of Uric acid in order to conserve H_2O and to prevent dehydration.

In birds the uriniferous tubule of kidney are added with Henley's loop, efficient in H_2O absorption as urinary bladder is absent to reduce weight.

- 6) Circulatory System and Warm bloodedness: → Most Terrestrial animals particularly mammals possess a well developed circulatory system. However in volant animals especially in birds when rapid metabolism is required blood supply to tissues increases which can be achieved by efficient circulatory system and the heart is large & efficient.

Birds and animals are able to maintain a constant body temperature that in birds allow them to fly and remain active.

- 7) Retrogression of Endocrine system: → In particularly cave dwelling animals the endocrine system as exhibit varying degree of degeneration especially in cave Urodel. The thyroid in proteus is said to secrete a hormone which has no effect on body tissue.

- 8) Osmoregulation: → The terrestrial organisms do not live in moist environment.

ment and have a relative impermeable outer body surface and their renal organs play a crucial role in controlling of fluid balance. Insects

excrete α Urine and faeces as dry pellet and sufficient H_2O can be obtained from oxidation of food.

Best example is of Camel & other desert animals which excrete Concentrate Urine and metabolism of food steps sent a source of H_2O .

9) Nervous System and Sense Organs: \rightarrow Nervous system is well developed. In flying animals cerebellum is highly developed. Birds have to depend mostly on sense of sight so eyes and optic lobe are well developed but organs of smell are poorly developed.

10) Reproductive Organs: \rightarrow Sexual dimorphism present in most (terrestrial) organisms. In birds there is retention of single ovary therefore oviduct is also reduced.