B.Sc. Part II, Paper III 'A'

Flight Adaptations in Birds (Part II)

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Contd. from Part I →

7. **Perching** :— The hindlimb in Birds are well-specialized for arboreal life. Their muscles are developed in such a manner that when a bird sits on a branch of tree, the toes close around the twig automatically. This happens due to so called Perching mechanism. When the bird settles on the branches of a tree; the legs are bent and put the flexor tendons on the stretch with the exertion of the pull, the toes are bent spontaneously around the perch. A bird can go to sleep in this position without any fear of falling off.

8. **Short tail** :— This bears a tuft of long tail feathers or rectrices, which spread out in a fan like manner and serve as an radar during flight. They also help in steering, lifting and counterbalancing during flying

oval perching.

B: Anatomical Adaptation

Birds have developed adaptations in their anatomy also —

1. **Flight Muscles**:- The action of the wings is controlled by the flight muscles, which are greatly developed weighing about one sixth of the entire wt. of the body. While the muscles of the back remain greatly reduced, the muscle fibres comprising the flight muscles are of striated type and well vascularised ~~with~~ to withstand the fatigues after prolonged activity. The wings are depressed by large muscles, pectoralis major and ~~elevated~~ elevated by pectoralis minor. Other muscles are small and help the above muscles in their functioning.

2. **Light and rigid Endoskeleton**:- The skeletal framework of flying birds is very stout and is likely lightly built on the following; girder principle. Bones are Pneumatic, filled with and provided with a secondary

plastering to make them rigid. Bone-marrow is lacking in bones of birds. Further skeletal frame-work become compact, centralized, rigid due to fusion of bones. Endoskeleton of birds thus, contains the following characteristics – (i) The skull bones are fused like this and so a tendency towards a reduction in their no. There bones are firmly fused with each other. The postrior portion of the skull is spongy. Teeth lacking.

(ii) All the thoracic vertebrae except the last are fused into a single mass giving rigidity to the skeleton dorsal part of vertebral column. Fusion of vertebrae provides a firm fulcrum for the action of wing in striking air. The uncinate processes of thoracic ribs help in providing compactness, necessary for flight by Concentrating the mass.

(iii) The shortening of caudal vertebrae and formation of Pygostyle has assisted stability in air.

(iv) Sternum or breast bone is expanded having a median ridge or keel for the attachment of major flight muscles in flying birds.

(v) The fusion of distal tarsal with metatarsals to form a tarsometatarsus and that of proximal tarsals with the lower end of tibia to form a tibiotarsus; helps in strengthening the legs for bipedal [illegible]

(vi) The skeleton of forelimbs is completely modified for the attachment of feathers and flight muscles.

3. Digestive System :- The rate of metabolism in birds is very high, so the food requirement are great and digestion is rapid. Most birds are very selective in their diet accordingly, the beaks are variously modified. Further because undigested waste are minimum so rectum is small and reduced. The absence of gall bladder in birds minimises the body weight to some extent.

4. Respiratory System :- As a flying bird requires great and sustained power, respiratory Sys. is modified in such a way that the food is combusted rapidly and completely to liberate large amount of energy. For this purpose, the dense, compact and inelastic lungs are supplemented by a remarkable System of air sacs, which grow out from lungs and occupy all available space between internal organs, even extending to the cavities of hollow bones. Air sacs primarily reduce the specific gravity of the bird and also facilitate complete aeration of the lungs. The avian lungs are twice aerated than the mammalian lungs.

(5) Circulatory System :- Rapid metabolism requires large oxygen supply to the tissues, which can be achieved by an efficient Circulatory System. Accordingly, avian heart is large sized, four-chambered, powerful and efficient. Due to double Circulation, the oxygenated and deoxygenated blood remain completely separated. Further, red blood cells of birds contain large amount of haemoglobin which is responsible for quick and perfect supply of oxygen to body tissues.

(6) Warm-bloodedness :- Due to perfect aeration of blood, the body temperature remains high (40°-46°C) and does not change with change of environmental temp. For this reason, birds are warm-blooded or homothermal animals.

(7) Excretory System :- The avian excretory System becomes specialized in three ways -

(i) For the retention of water, the uriniferous tubules with Henle's loops are efficient in water absorption. The cloaca also serve to absorb water.

(ii) For reducing the weight of body, there occurs no urinary bladder and the semi-solid urine is immediately thrown out, not retained for long in the body.

(iii) The metabolic nitrogenous wastes are converted into less toxic and insoluble organic compounds such as uric acid and urates, which is an important physiological valuable adaptation.

8. Brain & Sense Organs :- Avian brain is highly developed consisting of well-developed centres of equilibrium, muscular co-ordination and instinct. The Cerebellum is much developed and convoluted, controlling the sense of equilibrium and muscular co-ordination. The Cerebrum is also large and relatively smooth controlling voluntary movements, behaviour, intelligence and memory. Eyes are large and optic lobes are well-developed due to acute vision. Sense of smell is poorly developed.

9. Reproductive System :- In female birds, the presence of a single functional ovary of left side leads to reduction of body weight which is essential for flight.