

Flight adaptations in birds

Bird flight is the primary mode of locomotion used by most bird species in which birds take off and fly. Flight helps birds in feeding, breeding, avoiding predators, and in migration. The flight motion comprises of hovering, taking off, and landing, involves many complex movements. Birds adapted over millions of years through evolution for specific environments, prey, predators, and other needs. Flight adaptations in birds are divided into two categories:

A. Morphological Adaptations

B. Anatomical Adaptations

Morphological Adaptations

1. Body shape

The birds have a spindle-shaped body to offer less air resistance during flight. This helps the birds to conserve energy and become more efficient at flying.

2. Compact body

The body of a bird is compact, dorsally strong and ventrally heavy to maintain equilibrium in the air. Their wings are attached on the thorax, the light organs like lungs and sacs are positioned high, the heavy muscles placed centrally are other features that help in flight.

3. Body covered with feathers

The feathers are smooth, directed backwards, and closely fitting which make the body streamlined and reduce friction during flight. It lightens the body weight and protects it from the effect of environmental temperature. They also have a wide surface area for striking the air.

Feathers add to the body buoyancy. It insulates the body and prevents any loss of heat from the body. This helps the birds to bear low temperatures at higher altitudes.

4. Forelimbs modified into wings

The forelimbs are modified into wings which is the only organ of flight. These consist of a framework of bones, muscles, nerves, feathers, and blood vessels.

The wings have a large surface area. They also support the bird in the air. The wings have a thick strong leading edge with a concave lower surface and a convex upper surface. This helps in increasing the air pressure below and reducing the air pressure above. Thus the bird can fly upward and forward during flight.

5. Mobile neck and head

The birds have a long and flexible neck which helps in the movement of head important for various functions. They possess a horny beak which helps them to pick the grains and insects while feeding.

6. Bipedal locomotion

The anterior part of the body of a bird helps in taking off during flight. The anterior part of the body also helps birds to land. The hindlimbs help in the locomotion on land. They can support the entire body weight of a bird.

7. Perching

When a bird sits on the branch of a tree, its toes wrap around the twig. This is known as perching. The muscles are so well-developed that a bird can sleep in that position without falling.

8. Short tail

The tail bears long feathers that spread like a fan and function as a rudder during flight. They also help in balancing, lifting, and steering while flying and perching.

Anatomical Adaptations

1. Flight muscles

The well-developed muscles control the action of the flight muscles. It weighs about 1/6th of the entire bird. The flight muscles are striated. The muscles on the wings are large. Other muscles help the above muscles in functioning.

2. Light and rigid endoskeleton

The birds have a very stout and light skeleton. The bones are hollow, filled with air sacs. They are provided with a secondary plastering to increase their rigidity. The bones are fused and lack bone marrow. The birds lack teeth. The thoracic vertebrae are fused except for the last one. This plays an essential role in the action of wings striking the air.

3. Digestive system

The birds have a very high rate of metabolism. Therefore, food digests rapidly. The length of the rectum is reduced because of the minimum undigested waste. They have no gall bladder which reduces the weight of the bird.

4. Respiratory system

The respiratory system of birds is designed in such a manner that the food is oxidised rapidly and a large amount of energy is liberated. Since the metabolism rate is higher, a large number of oxygen molecules are required by the body. For this, the lungs are provided which occupy the entire space between the internal organs.

5. Circulatory system

Rapid supply of oxygen is required by the blood due to rapid metabolism rate in birds. Therefore, birds require an efficient circulatory system. Birds have a four-chambered heart that performs double circulation. This prevents the mixing of oxygenated and deoxygenated blood. Also, the birds contain a large amount of haemoglobin in their red blood cells which helps in the quick aeration of body tissues.

6. Warm blooded

The temperature of the body of a bird remains high and does not change with the change in the environment. This facilitates the birds to fly at very high altitudes.

7. Excretory system

The nitrogenous waste is converted to less toxic organic compounds such as uric acid, and urates. They have no urinary bladder. The uriniferous tubules efficiently absorb water.

8. Brain and sense organs

Eyes are large and the large optic lobes correspond to the great development of sight. The eyes occupy a large portion of the head, and both eyes together are often heavier than the brain. The ability to accommodate rapidly is also well developed for birds must change quickly from a distant to a near vision in flight. The much developed and convoluted cerebellum indicates the delicate sense of equilibrium and the great power of muscular co-ordination belonging to birds. The enormous development of corpus striata in the cerebrum also adds to the extraordinary manoeuvrability to attain stability in flight.

9. Single ovary

Presence of a single functional ovary of the left side in the female bird also leads to reduction of weight which is so essential for flight.