Special Adaptations

Lightweight Skeleton

Most of the bones in a bird's body are hollow and thin, making them very lightweight. Many bones are strengthened by internal struts or braces similar to the trusses inside the wing of an airplane. In addition, many of the bones are fused (joined together), which provides extra strength.

Keen Eyesight

Having excellent sight is extremely important to birds as they fly among branches, search for food, look for a mate, and watch for enemies. Birds have very large eyes that occupy a major portion of the head. In addition, the eyes and optic regions of the brain are well developed. Their eyesight can change quickly from distant to near vision. This is important as they are flying among trees or swooping down from a high perch. It seems that birds can see color and have very keen visual perception—they can tell objects apart even when the objects are far away but close to each other. Most birds have sight perception that is several times better than that of people.

The eyes of most birds are located on the sides of their head, which gives them a large field of vision. Some predatory birds, like owls, have eyes in the front of their head, which gives them excellent depth perception. Depth perception means that they can judge distances precisely. (Owls cannot move their eyes in their eye sockets, but can turn their heads 270°.)

Excellent Hearing

The sense of hearing in birds is well developed. This helps them communicate with other birds, listen for danger, and locate prey. Birds have one ear on each side of their head. You cannot see the ears because they are typically small holes covered with feathers.

Poor Sense of Smell

Birds have two nostrils in their beaks. Although birds can see and hear well, most do not have a good sense of smell. A sense of smell may not be as important to animals that are adapted to spending most of their life off the ground. The turkey vulture is one exception, probably because its sense of smell leads it to food.

Preening

Birds use their beaks to **preen**, or smooth and straighten out, their feathers. If their feathers get rumpled and have breaks or gaps in them, they do not work efficiently for flight or for keeping the bird warm and dry. Most birds have an oil gland located on their back near the base of the tail. Birds press their beaks against the gland to get oil on their beak, then use their beaks to spread this oil over their feathers. This helps to condition and waterproof their feathers.

Efficient Breathing and Circulation

The breathing and blood circulation systems in birds are extremely efficient, which allows them to maintain a fast metabolism and high body temperature and to fly. Birds have a strong heart that beats rapidly (400-500 beats per minute for a small bird at rest compared to 60-90 beats per minute for a human). Their strong heart efficiently circulates the blood carrying oxygen throughout the bird, which is necessary for the strong flight muscles.

Birds have two small lungs with special air sacs attached to each one. These air sacs extend into many parts of the bird's body, including the hollow parts of some bones. This allows the bird to store more air. Air moves through the lung tissue of birds in only one direction, which is much more efficient than in humans where the air is inhaled and then goes back where it came from to be exhaled.

"In full flight, a bird's wing can beat very rapidly (27 strokes per second in chickadees, more than 50 strokes per second in hummingbirds). When a bird is flying at its normal pace, the flight muscles develop oscillatory rhythms that are self-sustaining for brief periods, so that nerve stimulation to muscles need not occur on each stroke. The effect is like a spinning bicycle wheel, which once in motion needs only an occasional boost to sustain a constant speed."

—Sibley Guide to Birds