

What are the functions of feathers?

insulation for controlling body temperature – most adult birds are covered with feathers except on the beak, eyes, and feet.

aerodynamic power for flight

colors for communication

colors for camouflage

also – modified feathers are important in:

swimming

sound production (e.g., Ruffed Grouse, Nighthawk, plus the Club-winged Manakin in the Amazon claps its wings together in a courtship display flight.)

hearing

protection

cleanliness

water repellency

water transport (to young)

tactile sensation

support (woodpecker tails)

Feathers consist mainly of what material?

91% protein, 1.3% fat, 7.9% water.

Keratin –is an insoluble protein, containing sulfur, present in horns, hair, scales, and nails. However, the keratin found in bird feathers and in the scales on bird feet are different than in modern reptile scales.

What are the basic parts of a feather?

calamus (short a) – or quill anchors the feather in a follicle below the surface of the skin, i.e., this part of the feather is implanted in a socket in the skin

rachis (long a) - the main shaft of the feather that supports the vane

vane – consists of the branches called barbs consisting of a

ramus (main support of barb), barbule (consisting of cross bars – consists of single cells linked end to end), and barbicle (little hooks holding onto barbules.

What are the basic types of feathers?

1] Contour feather –

a) body feathers: the vanes are symmetrical on most body feathers. The portion of the vanes at the end of the feather nearest the body are downy – soft, loose, and often fluffy. The barbules do not consist of hooked barbicles. This part of the feather next to the body functions in insulation. The vanes at the farther end are firm, compact, and closely knit. This part away from the body protects the body from moisture, the skin from injury, and colors and shapes for displays. The water repellency of contour feathers is determined mainly by the interlocking structure of the barbules, but a film of uropygial (ur-o-pyg'-ial) oil gland secretion is also necessary.

b) **flight feathers**: the vanes are asymmetrical on flight feathers of the wing and tail. The flight feathers of the wing are the **remiges** (short e) (singular is **remix** – long e) These feathers are also characterized as **pennaceous**, i.e., the barbs are firmly textured and tightly interlocking.

The **remiges** are the flight feathers of the **wing**. They primarily serve aerodynamic functions and have very little importance in insulation. Birds typically have 10 primaries in the wings, as well as about 15 secondaries, plus many coverts – feathers that cover the bases of the flight feathers.

The **rectrices** are the flight feathers of the **tail**. There are usually **12 rectrices** and function primarily in steering and braking during flight.

c) **ear coverts** – these are small contour feathers that cover the external ear opening and function to screen the ear opening without blocking sound.

2) **Semiplumes** This type of feather combines a large rachis with mostly downy vanes. Semiplumes are intermediates between contour and down feathers. They function to fill in between contour and downy feathers. They have a large rachis with loose vanes.

3) **Down Feathers** wholly fluffy feathers that lack a rachis and interlocking barbicels. Down feathers provide excellent natural, lightweight thermal insulation.

a) **natal down** or nestling down found on birds at hatching or soon after. Natal down is a distinct feather generation and tends to precede contour feathers or adult down feathers.

b) **definitive down** – down feathers on the body after the natal down.

c) **uropygial gland down** – the uropygial gland at the base of the tail may have a tuft of down feathers that aids in transferring the oil secretion from the gland to the bill.

d) **powder down** – modified feathers that shed an extremely fine white powder formed by the breaking of the barbule tips. Its function is to aid waterproofing.

4) **Bristles** feathers with a stiff shaft and barbs only on the proximal portion, if at all. Bristles occur most commonly around the base of the bill, around the eyes, and nostrils of some birds (crows and jays). For example, bristles are used for insect nets around the bill.

5) **Filoplumes** hairlike feathers that consist of a very fine shaft with a few short barbs at the end. Usually they are covered by other feathers. They appear to function as pressure and vibration receptors and sense the location of other feathers so they can adjust properly. Each flight feather may have 8-12 filoplumes. The “hairs” on a plucked chicken are filoplumes.

How many feathers does a bird have?

Tundra Swan – 25,000 feathers (20,000 on its head and neck – 80%).

Songbirds – 2,000 – 4,000 feathers (30%-40% on head and neck)

weight: In general, the feather coats of birds weigh two to three times as much as their bones. Bald Eagle – feathers 17% and bones 7%;

How are feathers distributed over the body? – evenly? randomly?

Although feathers over the entire body of a bird, they are not attached to the skin evenly or uniformly in most birds. Feathers are grouped into feather tracts or pterylae which are separated by regions of skin with few or no feathers – called apteria. There are eight major feather tracts. Penguins lack apteria and feathers cover all the skin.

Are feathers living or dead structures?

Dead. There is no internal feather system of nourishment and maintenance. No nerves, muscles, or blood vessels lie beneath the outer surface of the exposed feather.

How are feathers repaired?

The only mechanism for repair of damage is replacement of the whole feather.

What is a molt?

A usual, regular replacement of feathers with age and season.

Why is the uropygial gland so important?

Feathers would become brittle with age and exposure except that the uropygial gland (preen gland) supplies an oily waxy substance and is an essential accessory to feathers. It is applied externally with the bill and cleans feathers and preserves feather moistness and flexibility. The secretions also help control bacteria and fungi growing on feathers. Water birds have very large uropygial glands. Birds may preen their feathers about once an hour.

What mechanism directly causes the loss of a feather?

An emerging new feather pushes the old feather out of its socket or follicle.

What keeps a feather from normally just falling out of its socket?

The follicle grips the feather at the calamus by a combination of muscle tightening and friction. A lot of force is required to remove. The follicular muscles are controlled by the autonomic nervous system. Sometimes a bird will become “frightened”, the muscles will relax, and feathers are lost. This is called a “fright molt.” They grow back.

How often does a bird molt?

Usually birds molt 2-3 times the first year and then 1-2 times each year after that. Some adult birds molt only once a year. A yearly molt is often sufficient to offset normal rates of feather wear. Molting is usually gradual and feathers are lost and replaced in an orderly fashion. In some birds such as loons, gulls, and waterfowl, all flight feathers are lost simultaneously.

Why does a bird molt?

Birds molt primarily because their feathers wear out and need replacement. Another reason is a change in color for different seasons and reproduction, e.g., to attract a mate during the breeding season.

What is the usual sequence of feather loss of the flight primaries?

From the innermost primary outward to the last feather of the wing tip. Tail feathers also follow this basic pattern from the innermost pair to the outermost pair.

What are the functions of feather color?

Insulation from or absorption of heat/light – e.g., light colored desert birds and dark colored cold climate birds, e.g. Juncos around here.

Cryptic coloration

mimicking – e.g., whip-poor-will, bittern
disruptive e.g., killdeer

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attraction for groups and individuals

Which pigment is associated with feather strength and resistance to wear?

Melanins. Extra keratin is associated with the dark melanin pigment and the combination makes the feather more resistant to wear. Dense melanin concentrations in the black wingtips of high-speed flyers, such as gulls reduce fraying of those feathers. (consider frayed flags on flag poles) This combination of melanins and keratin help protect desert species from sand abrasion. Melanins also absorb radiant energy, which aids thermoregulation. (beach parking lots – walk on white lines which are noticeably cooler than the blacktop of the rest of the parking lot.

Why does a Ruby-throated Hummingbird's throat sometimes appear black instead of ruby-red?

The red color is due not to a pigment but to the structure of the feather to give the iridescent red. The angle of incidence of the light striking the feathers determines the color, not a pigment.