



**Shush.** The great gray owl needs silence as it hunts for mice and other small prey. Its soft feathers have fringed edges and fuzzy surfaces that muffle the sound of its broad wings beating in the air.

BILL MARCHEL

# The Nature of Feathers



by VAL CUNNINGHAM

When a bird wakes up in the morning, it is dressed for the day. A bird doesn't need a coat and hat for the cold, or shorts and T-shirt to beat the heat. A bird doesn't need sunscreen to prevent sunburn, nor a raincoat to stay dry.

Birds are some of the most successful animals on Earth. They live in nearly all climates, from tropical rainforests to icy seas near the poles. Birds can endure temperature extremes better than mammals, reptiles, amphibians, and insects can. And if the weather gets too bad, they can fly somewhere else.

What is their secret to success? Feathers, the all-in-one body covering that sets birds apart in the animal kingdom. Only birds have feathers, and any animal that has feathers is a bird. Among other things, feathers enable birds to fly and to stay warm.

## A Survival Suit for Birds

Like our hair and fingernails, feathers are made of a protein called *keratin*. A feather has a central shaft, with many parallel branches called *barbs* on both sides.

On many feathers, such as flight and tail feathers, each barb has small barbules and even smaller barbicels with hooklets, tiny parts that interlock to keep the surface of the feather smooth and weatherproof.

If you run your fingers down the barbs from tip to base, you'll notice the feather looks ragged. The gaps form as the barbules pull apart from each other. Run your fingers back up the feather, and the barbules hook up again, forming a smooth surface.

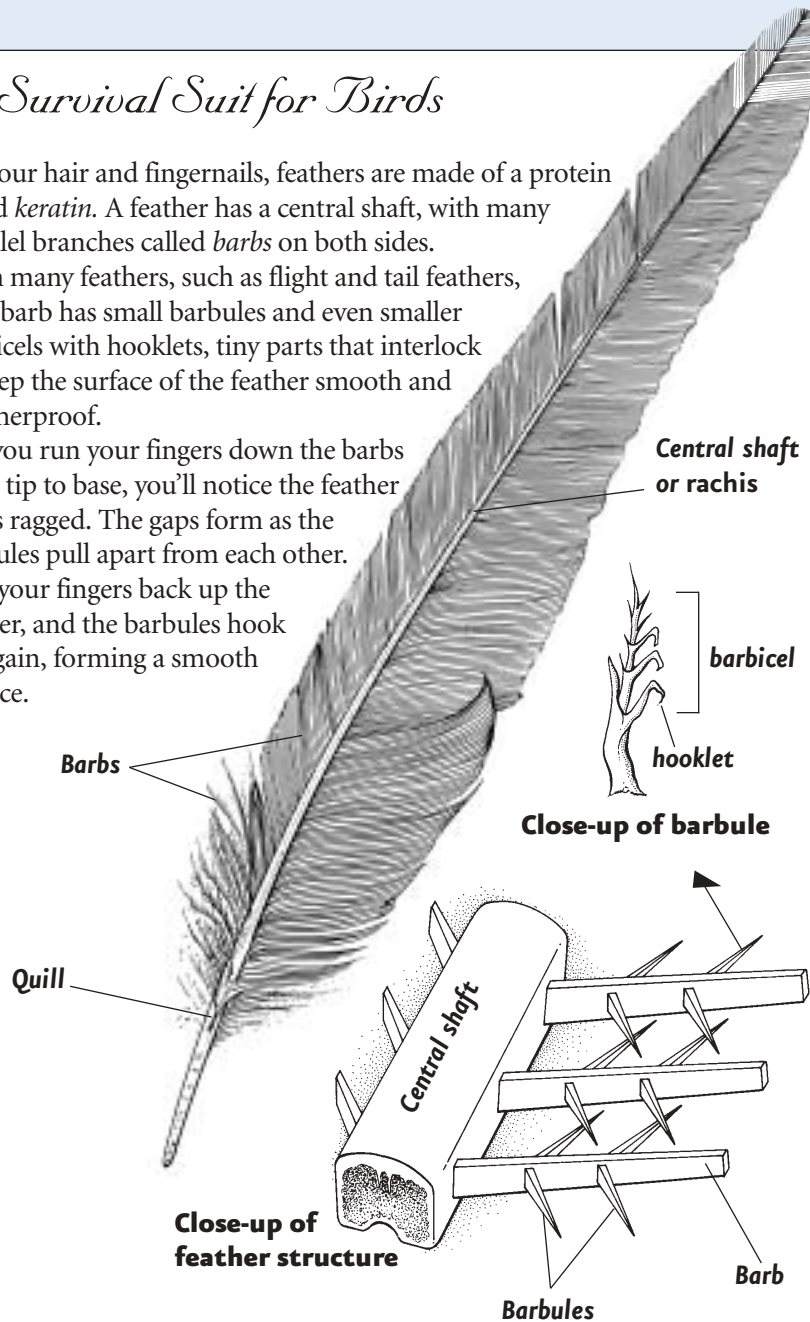
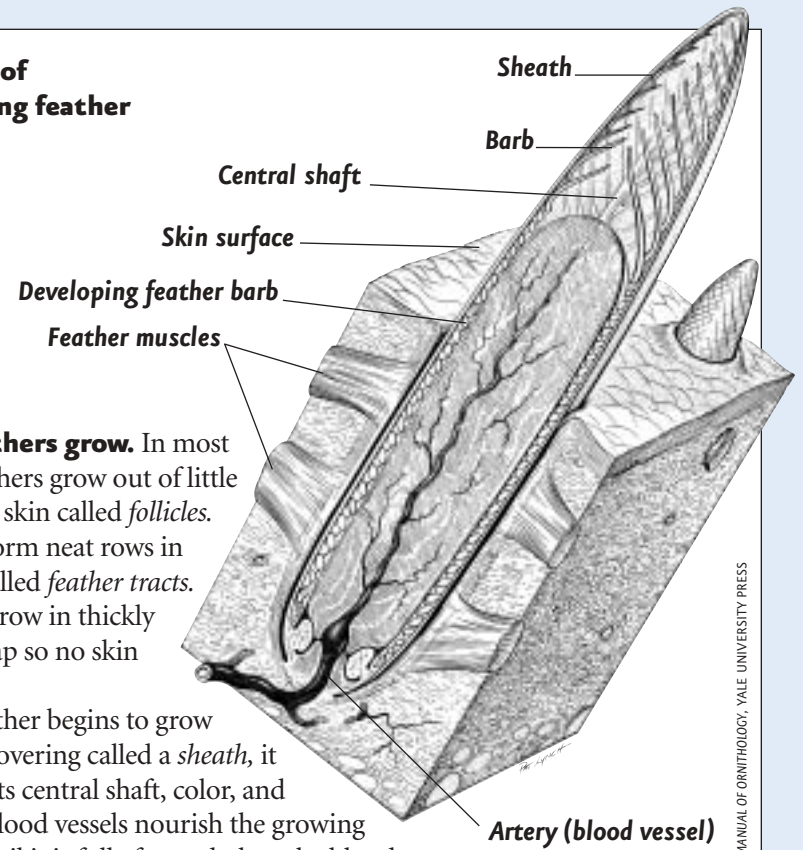


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## Drawing of developing feather



**How feathers grow.** In most birds, feathers grow out of little pits in the skin called *follicles*. Follicles form neat rows in patches called *feather tracts*. Feathers grow in thickly and overlap so no skin shows.

As a feather begins to grow within a covering called a *sheath*, it develops its central shaft, color, and pattern. Blood vessels nourish the growing feather until it is fully formed, then the blood vessels wither away. The sheath bursts open and falls off, or the bird removes the sheath with its beak.

**How feathers move.** A bird can move each of its feathers independently, using tiny muscles in the skin. This helps a bird place its wing feathers, for example, into position to make a turn or slow down.

**Feather tracts.** The shaded areas show where feather tracts grow on songbirds.

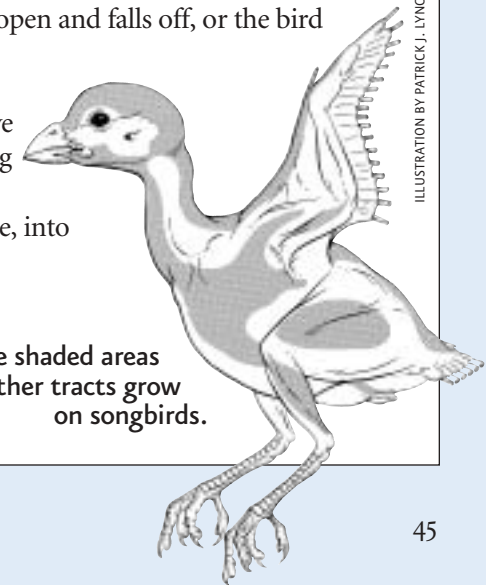


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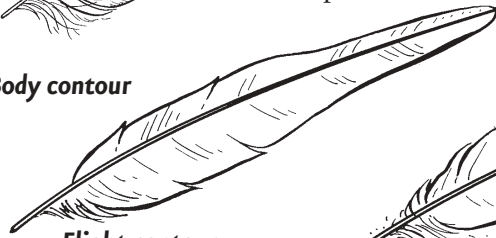
## Types of Feathers

Every bird has several different types of feathers. Each has a different function. These drawings give a general idea of what each type looks like. In nature the appearance of feathers varies a great deal.

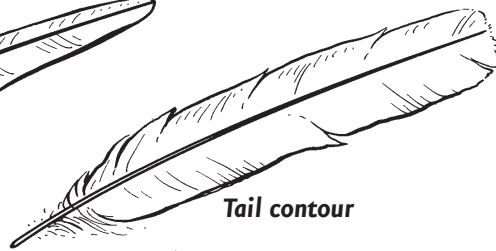


**Contour.** Contour feathers on body, wing, and tail give a bird a streamlined shape and allow it to fly. A single contour feather may be made up of a million small parts.

Body contour

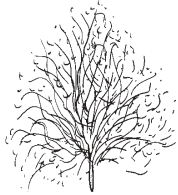


Flight contour



Tail contour

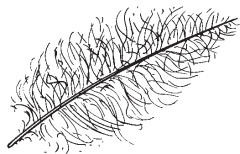
**Down.** These fluffy feathers grow near the skin under contour feathers. Down traps warm air, insulating the bird from cold. Unlike contour feathers, down does not have barbules to keep the surface smooth.



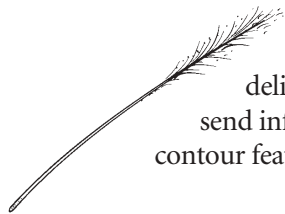
Adult down



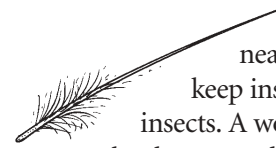
Natal (chick) down



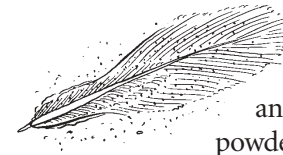
**Semiplume.** These look like a combination of contour and down feathers. Like down, they help trap heat next to the skin.



**Filoplume.** Scattered over the body, these small, delicate feathers move easily. Their tiny movements send information to nerve cells to tell a bird when its contour feathers need adjusting.

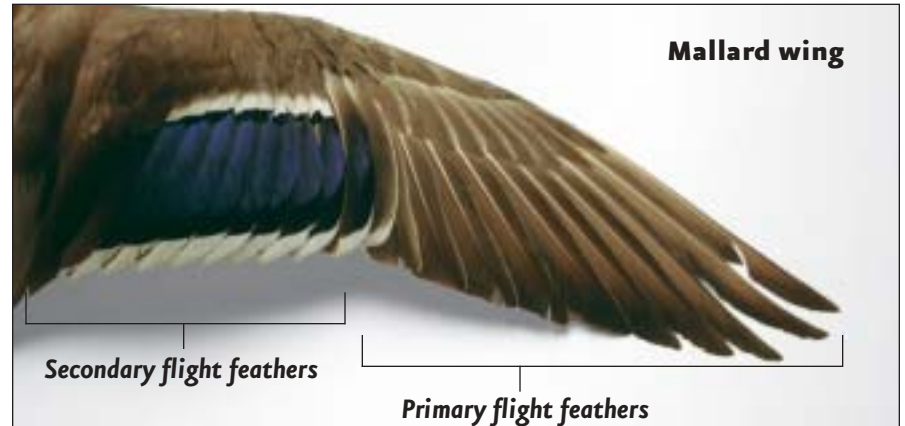


**Bristle.** Some birds have stiff, hairlike feathers near the eyes or nose. For example, bristles help keep insects out of a swallow's eyes as it flies to catch insects. A woodpecker hammering away at a tree has bristles that keep wood dust out of its nostrils.



**Powder down.** These fragile feathers break into a fine powder that sifts over other feathers and helps remove dirt. Herons actually rub the powder on their feathers.

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Mallard wing

Secondary flight feathers

Primary flight feathers

**Light but strong.** Feathers are some of the lightest but strongest materials in nature. They can withstand raging winds, rain, snowstorms, high doses of sunlight, and collisions with tree branches. Feathers are flexible too. You can bend a feather shaft, and it will straighten back up.

Flight feathers are extra strong in ducks, geese, swans, and a few other birds. They have specially shaped barbs that help keep the feathers from being driven apart by wind, making them more suitable for high-speed travel. Unlike other feathers, secondary flight feathers attach directly to the wing bone. This adds stability for flight control.



Secondary flight feathers attach directly to a wing bone.

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## Feather Colors

Bird feathers come in all colors of a rainbow, making birds as colorful as coral reef fish or drab as mice.

Have you seen a bright red male cardinal or a blue jay in your neighborhood? The colors you see on these birds form in two different ways: by pigments and by structures.

**Pigment colors.** Most feather colors are produced by pigments called *carotenoids* or *melanins*. Both kinds of pigment absorb certain wavelengths of light and reflect the rest. We see the reflected light as color.

Carotenoids reflect bright yellow, red, and orange light. Cardinals get carotenoids from seeds they eat.

Most birds get their color from melanin, the same chemical that colors our skin. Birds make melanin from chemical building blocks within their bodies. Melanins produce black, gray, or brown colors. Melanin also strengthens feathers. As a result, black wingtips are stronger than white ones are.

A northern cardinal has red pigment in its feathers.



GEORGE E. STEWART, DEMBINSKY PHOTO ASSOCIATES

American goldfinch feathers have yellow from carotenoids and black from melanin.



RANDALL B. HENNE, DEMBINSKY PHOTO ASSOCIATES

An indigo bunting looks blue, but its feathers contain no blue pigment.



CARLE R. SAMS II, DEMBINSKY PHOTO ASSOCIATES

Common grackle feathers have layers of cells that reflect light like a soap bubble does.



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**Structural colors.** The other kind of feather color is not a pigment color. It is what we see when light hits the parts of the feather (structure). We see feather color because light reflects from or scatters through thin layers of cell walls in the barbs.

When the structure of a feather reflects all of the light, we see white. White is a structural color.

Blue and most green colors are also structural. Blue jays look blue, but their feathers have no blue pigment. A blue jay's feathers have melanin below the surface under a layer of bubblelike cells. These bubbles reflect and scatter blue light waves, and melanin absorbs the other colors of light. That's why the blue jay's feathers look blue in sunlight. But in the shade, the melanin shows up better, and the feathers look blue-gray.

Iridescent colors, such as a male hummingbird's brilliant throat patch, also are structural. Iridescent feathers have several layers of bubbles. In some birds these layers are twisted, absorbing or reflecting various wavelengths of light. The layers reflect light as a soap bubble does, with colors shifting as your point of view changes.

**Invisible colors.** Many birds have patches of feathers that reflect ultraviolet light. Birds can see ultraviolet light, which humans can't see. So what we see as a black or blue bird might look much more colorful to other birds. A female bird might choose a mate based on the brightness of his ultraviolet feathers.

**Mallard drake, eclipsed or summer plumage.** Except for his green bill, this male is hard to tell apart from a hen now.



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## Molts and Plumage

Bird feathers do wear out. Once or twice a year, birds shed their old feathers and grow new ones. This process is called *molting*. Most birds molt in late summer or fall, after they have raised their young and before they migrate to their winter home.

As new feathers grow, they push out old ones. Most birds molt one feather from each wing at a time so they can keep their balance in the air. Many ducks and geese molt all flight feathers at once, so they can't fly for several weeks and must avoid predators by swimming away or hiding on islands. Most birds take weeks to grow a completely new coat of feathers.

Fluffy down covers newly hatched birds. Within about three weeks, new feathers grow in. These are less colorful than adult feathers. They camouflage the young birds until they learn to fly and avoid predators.

When birds molt in fall, their new feathers are usually much duller than their springtime feathers. Just before spring, some birds undergo a partial

**Val Cunningham** is a nature writer and editor in St. Paul who spends as much time as she can outdoors watching birds and other wildlife.

**Mallard ducklings have natal down.**



BILL MARCHEL

molt, adding some bright, new feathers to attract a mate.

Most male birds have colorful or showy feathers to

attract female birds and tell other males to stay away from their territories. The male wild turkey, for example, sports long tail feathers to impress females and other males. The male cardinal is bright red, while the female is a soft tan color. Females' camouflage allows them to sit on their nests without being seen by predators.

## Feather Care

Birds spend a lot of time *preening*—keeping their feathers clean and in good condition. Their ability to fly and to keep warm depends on a well-maintained feather coat.

Birds bathe in birdbaths, along lakeshores and rivers, and even in puddles. After a bath, a bird uses its beak to smooth out its feathers and nibble or pluck away dirt and parasites. With its beak, a bird “zips up” its flight feathers, closing all the gaps that might allow air to flow through and slow down its flight.

Some birds, such as house sparrows, often bathe in dust, which absorbs grime and wipes out parasites.

Most birds finish preening by using the beak to take waxy oil from a preen gland near the tail and spread it on their feathers. The oil keeps feathers flexible. It might also prevent the growth of harmful bacteria and fungi.



**Mallard drake, breeding or winter plumage.** You can see why hunters call these ducks *greenheads* or *greenies*.

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**Mallard preen gland**



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## Fun Feather Facts

Small birds have smaller and fewer feathers than large birds do. A hummingbird, for example, has about 950 feathers covering its tiny body, while a swan has about 25,000 feathers. All feathers are lightweight and strong.

A bird's feathers help it to maintain its high internal temperature, from 105 to 108 degrees, depending on the species.

Some birds grow more feathers to help them beat the cold in winter. A house sparrow, for example, has about 3,100 feathers in June, but 3,500 in January.

A dark blue bird, such as an indigo bunting, has a great deal of melanin in its feathers. Buntings look very dark in the shade because we no longer see light reflecting off their feathers.

Birds can dare to be colorful because, if their bright feathers attract a predator, they can fly away from danger.

Humans have not been able to invent anything that holds warmth better than down feathers. Because feathers insulate better than fur does, a chickadee can stand the cold better than a chipmunk can.

### Attention Teachers

To find an online teachers guide for this article, visit [www.dnr.state.mn.us/young\\_naturalists/feathers](http://www.dnr.state.mn.us/young_naturalists/feathers). To learn more about using *Minnesota Conservation Volunteer* as a teaching tool, contact Meredith McNab, [meredith.mcnab@dnr.state.mn.us](mailto:meredith.mcnab@dnr.state.mn.us) or 651-215-0615.

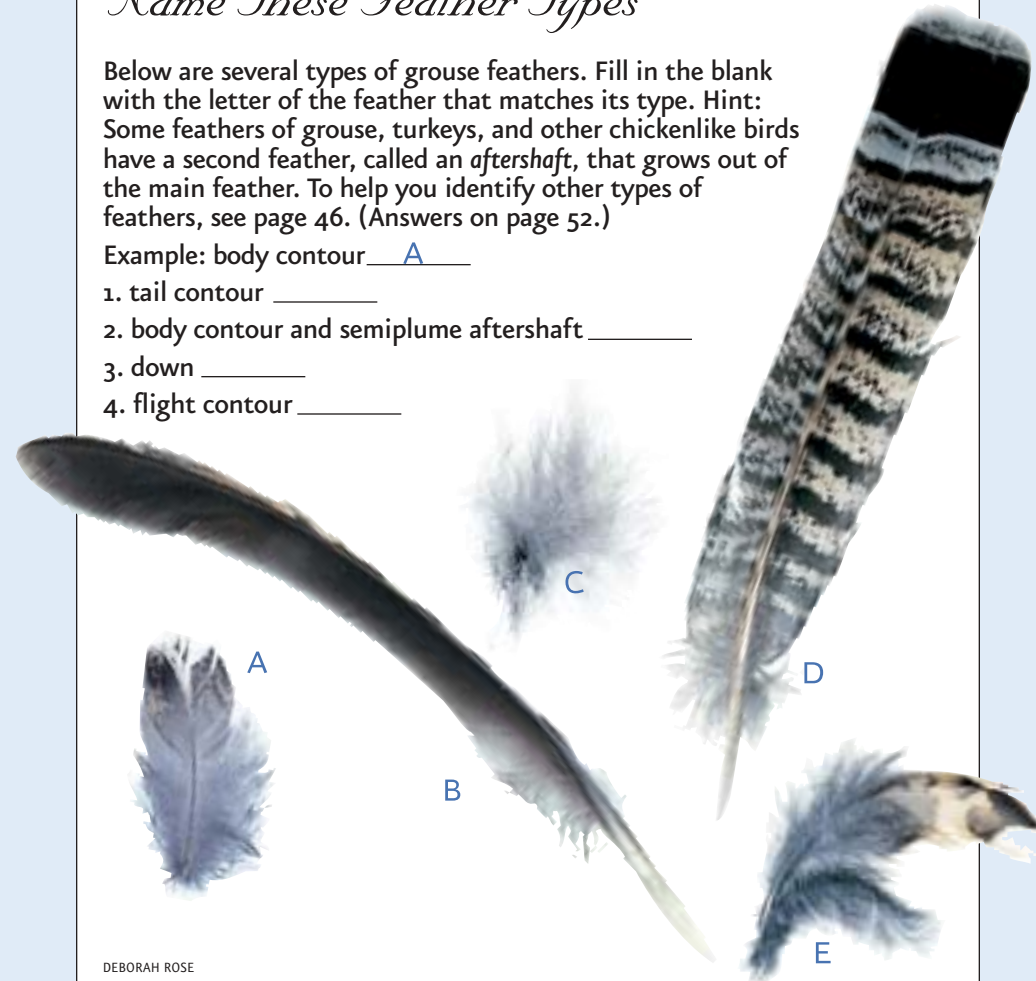
Answers to page 53: 1. D, 2. E, 3. C, 4. B

## Name These Feather Types

Below are several types of grouse feathers. Fill in the blank with the letter of the feather that matches its type. Hint: Some feathers of grouse, turkeys, and other chickenlike birds have a second feather, called an *aftershaft*, that grows out of the main feather. To help you identify other types of feathers, see page 46. (Answers on page 52.)

Example: body contour A

- tail contour \_\_\_\_\_
- body contour and semiplume aftershaft \_\_\_\_\_
- down \_\_\_\_\_
- flight contour \_\_\_\_\_



DEBORAH ROSE

online

For illustrations of the kinds of feathers on a bird:  
[www.earthlife.net/birds/feathers.html](http://www.earthlife.net/birds/feathers.html)

To test what you know about feathers:  
[www.nmnh.si.edu/BIRDNET/FeatherQuest/FeatherQuest.html](http://www.nmnh.si.edu/BIRDNET/FeatherQuest/FeatherQuest.html)