

Bird Feathers

Objective

Students will use a hand-held microscope to examine the structure of feathers and discuss the way various feathers serve different functions for the bird.



Background

Feathers are unique to birds. They are a defining characteristic of the group, meaning simply that if an animal has feathers, then it is a bird. Feathers serve many functions in birds but most notable is the critical role feathers play in enabling birds to fly. Unlike feathers, flight is not a characteristic restricted to birds—bats fly with great agility and insects fluttered through the air several million years before birds joined them. But feathers have enabled birds to refine flight to an art form matched by no other organism alive today.

In addition to helping to enable flight, feathers also provide protection from the elements. Feathers provide birds with waterproofing and insulation, camouflage, display and even block harmful UV rays from reaching birds' skin.

Feathers are made up of keratin, an insoluble protein that is also found in mammalian hair, fingernails, horns on some animals, bird beaks, and reptilian scales.

Birds have good eyesight and color is important to them. A bird gets its beautiful or cryptic coloration from its feathers. Feathers in turn get their colors in two ways:

- By producing melanin, colored pigments present in the Keratin.
- From carotenoids which make reds, oranges and yellows that they get from the foods they eat. For example, if Flamingoes do not get the correct nutrients (naturally found in their diet in the wild) they will lose their pink coloring. Zoos had a hard time keeping their flamingoes pink until they figured this out.

Feathers have a basic form of a hollow, central shaft called a rachis and a number of smaller side branches. The side branches are called barbs and are linked together by a set of barbules and their "hooklets" or Hamuli (put the diagram on Elmo). The base of the feather - where there are no side branches - is called the calamus or quill.

Feathers suffer wear and tear as they are exposed to the elements. Over time, the quality of each feather deteriorates and thus compromises its ability to serve the bird in flight or to provide insulation qualities. So to prevent feather deterioration, birds shed and replace their feathers periodically in a process called molting.

Materials

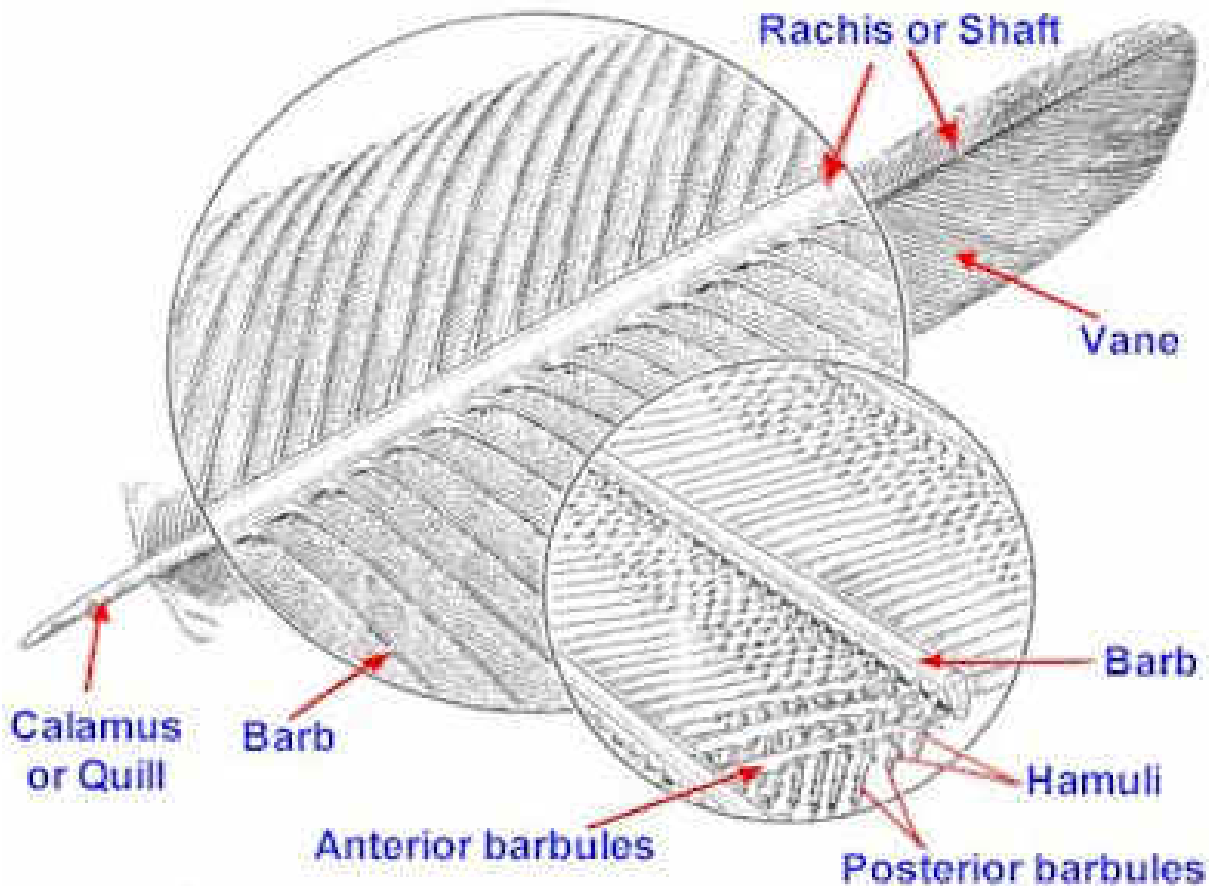
- Colored pencils
- Diagram of Basic Feather form
- Diagram of the different types of feathers
- Blank drawing paper
- Feathers
- Hand-held Microscopes
- Hand sanitizer

Activity

1. Discuss the background information on feathers and why they are important to birds.
2. Remind students to be gentle with the feathers and microscopes. Pass out a feather, one sheet of paper, a microscope, and colored pencils to the students.
3. Types of feathers in the box: Peacock, Ostrich (large gray plumes), Pheasant (long, light brown, with dark horizontal bands), Guinea Hen (small feathers with white dots), and Chicken (some black rooster tail feathers and other medium-size fluffy feathers).
4. Ask students to examine the feather using the microscope. Notice the strong shaft (spine) and the many thread-like filaments attached on either side of the spine.

Beginning at the spine, have them stroke an area where the filaments are separated. Each filament has hundreds of tiny hooks, called barbules that hold the filament together to make the long flat surface, called a vane. Have students describe what they feel. Is there a man-made device similar to this? (Velcro)

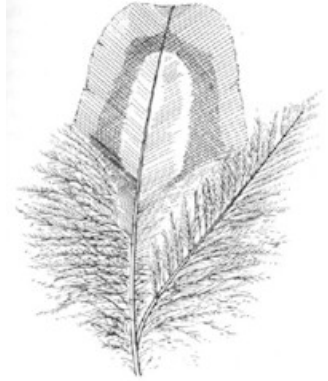
5. Ask the students to draw the feather. Students can trade and draw another feather if they have time. Ask them what they would use feathers for (no correct answers here).
6. After the activity, have students clean their hands with hand sanitizer. The feathers have been cleaned and steam-sanitized, but hand-washing is still a good idea.



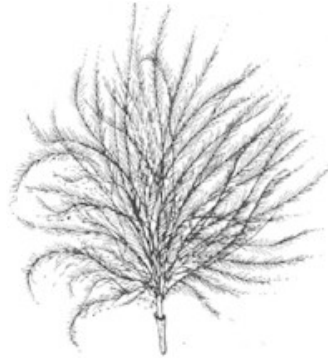
Birds have several different types of feathers and each type is specialized to serve a different function. In general, feather types include:

Contour feathers give the bird its characteristic smooth round shape. They also give the bird its visual coloring and provide a first level of defense against physical objects, sunlight, wind and rain. They are very important.

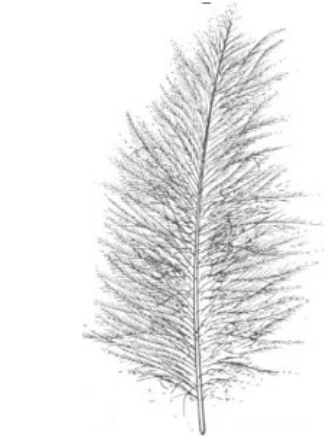
Remiges (or flight feathers) and Retrices (or tail feathers) are types of contour feathers.



Down feathers are smaller and lack the barbules and their accompanying hooklets so they are not zipped together and do not look as neat. In fact they are soft and fluffy. They provide most of the insulation and are so good at this that mankind for many years collected down feathers from various birds to put into sleeping bags and jackets to help keep us warm.



Semiplumes are half-way between a contour feather and a down feather. These occur between the contour feathers and help to supply insulation and a certain amount of form as well.



Filoplumes are very small and have only a very few barbs at their tips. They are believed to have a sensory function, helping birds keep their feathers in order.



Weird Feathers on Birds:

There are a few birds that have highly modified feathers. The following are some notable ones.

Owls have velvet-like projections that extend from their feathers that allow them to fly silently.

Sand-Grouse that live in desert locations have feathers with highly curled barbs. These barbs will hold water when a bird dips into an oasis. This allows the bird to then fly back to the nestlings and they can drink from the birds' breast.

Manikins: In the neotropical forest, manikins will often snap their feathers down, creating a very loud fire-cracker like sound. This is caused by the secondary feathers that have very large shafts.

Motmots: The tail-feathers of mot-mots are extremely elongated. These are probably used to give some sort of social signal to others of their kind.

Spatuletail Hummingbird: The Marvelous Spatuletail has a very long extended tail feather. Scientists do not know exactly what the purpose of this is. It is doubtful that there are any improvements in their flight because of it.

Honeyguides and Snipes: Their tail-feathers have a lot of space in between them. When air passes through it causes turbulence and a lot of noise.

Woodpeckers: The shafts of the tails of woodpeckers are modified for support so that when they perch on the side of trees they can brace themselves vertically.

Caprimulgiform birds (nightjars and kin): These birds have highly modified feathers that look like whiskers. They are actually just contour feathers, but are probably sensory adaptations to help them catch bugs.

Bristle-thighed curlews: These birds have modified feathers associated with the upper portion of their leg. These feathers are probably extra sensory feathers to determine the depth of water they are standing in.

More Feather Facts for 3rd to 5th grades

The fourth main types of feathers are **Powder Feathers**. These are unusual in that they grow continuously and that they disintegrate at the tip. The barbs breaking down into a fine powder that in Herons at least is useful in mopping up the slime and dust that gets on their fronts during feeding. Thus they help keep the plumage clean. Powder feathers occur scattered throughout the plumage of most birds, but their function is not well understood.

Brood patches are areas where the feathers fall out during or immediately prior to incubation of the eggs. These areas of bare skin on the birds' abdomen are heavily infused with blood vessels and allow the incubating adult bird to transfer heat to the eggs thus speeding up development of the embryo. Brood patches are either one large patch or several smaller patches equating with the number of eggs – i.e. Herring gulls which normally lay 2-3 eggs have 3 brood patches. Brood patches are necessary because feathers are such good insulators that none of the adult's body heat would reach the eggs without them.

The longest feathers in the world belong to an ornamental chicken bred in Japan in 1972, this specimen had tail feathers 10.59m or 34.75ft long.

The longest feathers of a wild bird belong to the Crested Argus Pheasant *Rheinartia ocellata* which commonly reach lengths of 173cm or 5.7ft

Anchiornis huxleyi, which lived in what is now northeastern China between 151 million and 161 million years ago, is a peacock-sized dinosaur (older than *Archaeopteryx*) and the oldest known animal with feathers.

The fossils of *A. huxleyi* are so well preserved that they have found traces of melanin. From the melanin traces, scientists have been able to tell that this animal had bold patterns of plumage, orange on the head and neck and black and white bands on the 'wings.' The colors could have served any of a number of functions; besides communicating to members of its own species — a "come here, cutie" to members of the opposite sex, say, or a "back off" message to rival suitors — a quick flash of boldly colored plumage could startle an attacking predator or flush prey out of hiding.