ART + SCIENCE AT HOME

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FLIGHT ADAPTATIONS + FOCUS on FEATHERS

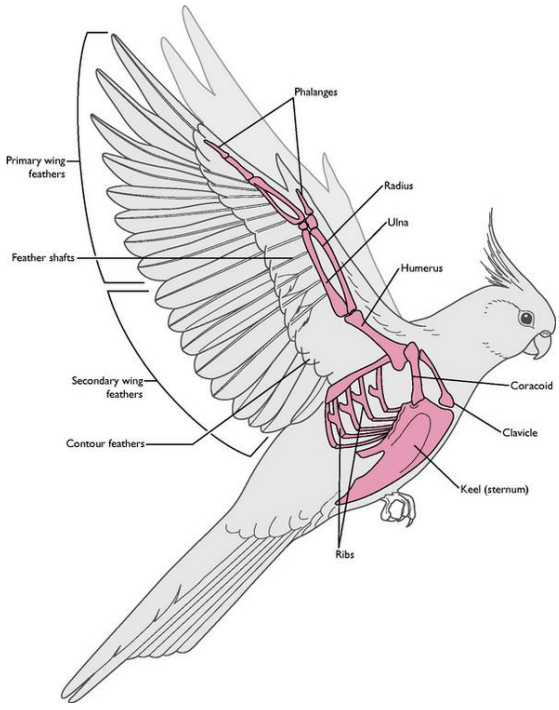
On Tuesday we looked at flight and patterns of movement through the air. Today we'll look a bit more deeply at the anatomical adaptations that make bird flight possible. With a few notable exceptions, including Penguins, the majority of birds are capable of flight. Bird bodies have adapted to take to the sky, and this ability is connected to many aspects of their morphology. Flight is not just a product of the presence of wings, though wings are essential to bird flight.

Another of the essential necessities for flight is overall lighter weight, and we can see evidence of this streamlining throughout a bird's body. Below is a **BRIEF** look at some of the adaptations in addition to wings that have allowed birds to get and stay off the ground (If you'd like to go into more depth, look here and here.

SKELETAL SYSTEM – Birds have a light and rigid skeleton. Many bird bones are fused or hollowed out, containing air spaces instead of marrow. The bones need to remain strong to keep up with the demands of life, so there are struts across the hollow areas. Birds have lightweight bills instead of heavy jaws and teeth.

DIGESTIVE SYSTEM – Most birds consume energy rich foods like fruit, seeds, meat and process this high calorie food through efficient digestive tracts. They tend to have high rates of metabolism, and digest food rapidly.

CIRCULATORY SYSTEM – Birds have a four chambered heart that efficiently circulates oxygen rich blood to tissues.



veteriankey.com

FEATHER TYPES

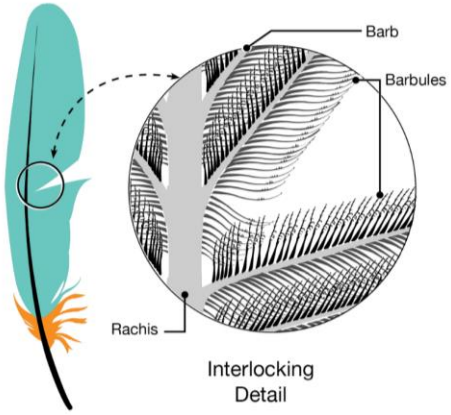
REPRODUCTIVE SYSTEM – The reproductive systems of many birds shrinks for most of the year, then grows during the breeding season. Female birds lay individual eggs and are not burdened by the weight of incubating their offspring internally.

RESPIRATORY SYSTEM – Larger and more efficient than that of mammals. Bird lungs are anatomically complex and have a larger capacity for oxygen and carbon dioxide exchange across membranes than in mammals. For comparison, about 1/5th of a bird's body volume is taken up by its respiratory system. In a mammal, it's about 1/20th of the body volume.

MUSCULAR SYSTEM - Large flight muscles attach to the keel structure of the sternum allowing for powerful flapping.

Finally, **FEATHERS.** Feathers provide a lightweight way to fly, insulation, waterproofing, camouflage, and colorful display to attract mates. Only birds have feathers. Number of feathers differs between species and can range from around 1,000 on Hummingbirds to more than 25,000 on Swans. You can find some great facts and images of feathers here.

Andrew Leech, allaboutbirds.org



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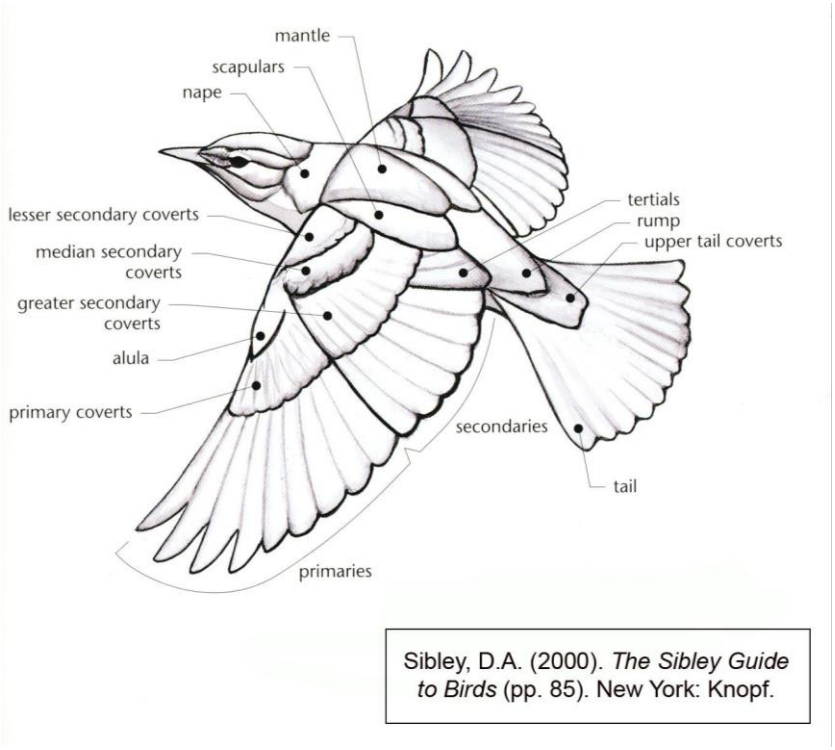
There are seven main types of feathers. Primary and secondary **WING FEATHERS** are long and rigid for flight. **TAIL FEATHERS** are long and help with directing flight patterns. Body, or **CONTOUR, FEATHERS** cover the insulating feathers and help streamline a bird's overall shape. **DOWN FEATHERS** are short, fluffy, and provide insulation. **SEMIPLUME FEATHERS** are less fluffy than down, but also provide insulation. Protective **BRISTLE FEATHERS** surround eyes and mouth and have no barbs. Mysterious **FILOPLUMES** may help birds assess damage to other feathers. On the left, you can see how the **BARBS** of feathers lock together to create a stable surface.

This diagram details how some of the **WING**, **TAIL**, and **CONTOUR** feathers are arranged on a songbird in flight.

The **DOWN, SEMIPLUME**, and **FILOPLUME** feathers are covered over, so they are not labeled here.

For more detail on bird feather anatomy, have a look here.



Sibley, D.A. (2000). *The Sibley Guide to Birds* (pp. 85). New York: Knopf.

STEP ONE: Gather your supplies

- You will need your fieldbook, art supplies, and a feather.
- Find a place where you can work comfortably. It's okay if you want to stay inside today. Or head out. Up to you!

STEP TWO: Examine a feather.

- Follow these steps and fill up a page in your fieldbook.
- Observe your feather for one minute. Look at the color and structure. Flip it over. Run your fingers over it.
- Gesture drawing. Do a quick drawing of your feather. Focus on trying to scribble the curve and shape down.
- Blind Contour drawing. Draw the outline of your feather without looking at the page while you draw.
- Contour drawing. Same as above, but you may look between your feather and the page while you draw.
- Six words. Or more. Write down at least six words about your feather.

STEP THREE: Draw your feather in greater detail.

- Now that you have warmed up your drawing and observation skills, let's do a longer, more detailed drawing.
- Using a pen or pencil, carefully draw your feather.
- Add color to your drawing.
- Label the parts of your feather.
- Can you identify which type of feather that you have?
- Do you know what species of bird the feather is from? It's okay if not. The US Fish and Wildlife Service has a feather identification atlas that might help.
- On the right is a Primary Wing feather from a Pigeon.
- The VANES are the entire surfaces of barbs, so the whole side of the feather is a vane

BONUS STEP: Copy these drawings of feathers.

- Copying is a great way to get a sense of the anatomy and keep track of the feather arrangements before you are trying to draw birds on the fly. Note how the secondaries cover the primaries in the folded wing diagram.

Here's a fun feather game from the Cornell Lab's Bird Academy and a flight game to help you learn about birds and flight.

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