Teacher Guide

UNIT 2 LESSON 2:
WINGS AND FLIGHT

Theme

Birds are masters of flight due to many different adaptations. A bird's wing shape allows for a certain type of flight that fits its lifestyle.

Missouri Science Standards: LS1.A.4, LS4.B.1, PS2.A.2

Vocabulary

Airfoil - A structure with curved surfaces designed to give the most favorable ratio of lift to drag in flight, used as the basic form of the wings, fins, and horizontal stabilizer of most aircraft.

Keel - Part of the bird's skeleton which supports the large flight muscles; the large bone grows out from the sternum (breastbone) and extends down the chest and stomach

Lift – The force that acts at a right angle to the direction of motion through the air. Lift is created by differences in air pressure.

Drag - The force that acts opposite to the direction of motion. Drag is caused by friction and differences in air pressure. Drag is the force exerted on an object (the bird) moving through a fluid (air or water).

Thrust – The force that propels a flying object in the direction of motion. Engines produce thrust. Birds create thrust by using their strong breast muscles to flap their wings. Thrust pushes the bird in the opposite direction than the air is being pushed (i.e., the bird pushes the air to the back and moves forward).

Gliding - Moving along smoothly and continuously. To fly without propulsion or thrust.

Flapping - Moving the wings up and down while changing the angle.

Elliptical wings - Good for short bursts of speed, fast takeoffs, and tight maneuvering. Examples: crows, ravens, thrushes, sparrows, and blackbirds

Soaring - Flying at great heights or rising upward without any visible movement of the wings

Active soaring wings - Long and narrow wings that allow birds to soar or fly for a long time without flapping, very dependent on wind currents. Examples: gulls, gannets, albatrosses.

Passive soaring wings - Long primary feathers that create "slots" by spreading out which allows the bird to rise higher in the air on "thermals" – vertical columns of hot air. Examples: eagles, storks, and most hawks.

High-speed wings - Long, thin wings designed for speed. Examples: ducks, falcons, sandpipers.

Hovering wings - Small, quick-moving wings with nerves and muscles adapted for fast movement. Example: hummingbirds

Common Misconceptions to Watch Out For:

- All birds can fly. Penguins use their wings to swim but are unable to fly.
- Birds don't fly at night. Many birds fly at night and some birds use the stars for navigation.
- Birds cannot fly backwards. In fact, the hummingbird can fly in any direction because of its hovering ability.

Video 1: Bird Flight Webinar

Video Description: Ever since there were people, people have watched birds fly and wondered how they did it, wondering also if they too could fly. In this webinar we bring together all the awesome adaptations we have learned about birds and connect how they enable them to take flight. We also cover the physics of flight and some examples of amazing fliers. Webinar is made by the Missouri River Bird Observatory.

Video Link: https://www.youtube.com/watch?v=_qc6TeJoSQk

Video 2: Bird Wing Shapes - How Birds Fly

Video description: This video describes the different wing shapes and how they benefit the bird. Video made by BioBush.

Video link: https://www.youtube.com/watch?v=cDN9qqoQZr8&feature=emb_logo

Follow-up Questions for Videos 1&2:

1. Fill in the blank. Flying birds have a _____, which is a ridge on the breastbone that is the main site of attachment for flight muscles.
2. True or False? For an object to overcome gravity, the amount of force created by lift must be greater than that created by gravity.
3. Fill in the blank. Birds that have passive or active _____ wings allow the birds to glide or fly without flapping their wings for a long time.
4. True or False? Hummingbirds have "hovering wings" which allow them to hover in the air for long periods of time.
5. Fill in the blank. The most common wing shape is the _____ wing.

Activity: The Bernoulli Principle and Bird Flight

Activity Summary: in this activity students will learn that birds are able to fly at different speeds and in different ways because of the shape of their wings and the Bernoulli Principle.

Teacher Notes:

- Wing Airplane Activity sheet and Thinking about Birds and The Bernoulli Principal Data Sheet included in the packet
- *Creating the individual "birds" will take the most time for this activity (~ 35 minutes)*
- *The Bernoulli Principle – as air moves around an object it creates different pressures on the object; faster air creates less pressure than slower air which creates more pressure.*
- *Since bird wings are curved, the air going over the top of the wing moves faster than the slower moving air on the bottom side of the wing which creates more air pressure, thereby pushing the wing up from beneath and lifting the bird up. A bird's flight depends on the shape of the bird's wing and the way they use them.*
- *see: https://ucmp.berkeley.edu/vertebrates/flight/physics.htm and https://birdsanctuary.kbs.msu.edu/wp-content/uploads/sites/2/2015/02/Flight_Investigation_2013.pdf*

Video 3: Experiment! How Does an Owl Fly So Silently?

Video description: This video shows an experiment comparing owls to other birds to try to figure out why owls have the adaptation of silent flight. Video made by BBC Earth.

Video link: https://www.youtube.com/watch?v=d_FEaFgJyfA&feature=emb_logo

Video 4: What makes owls so quiet and so deadly?

Video description: This video takes an up-close look at owl feathers to see how they help owls fly so silently. Video made by Deeplook.

Video link: https://www.youtube.com/watch?v=a68fIQzaDBY

Teacher Notes:

- *Owls have special feathers for nearly silent flight. This helps the owl to hunt because prey cannot hear them coming, and the owl can hear their prey as they fly toward it.*

Follow-Up Questions for Videos 3&4:

1. Fill in the blank. Owl flight feathers have comb-like serrations, also called _____ that help owls fly silently.
2. True or False? Some owls have feathers on their legs to muffle sound.
3. Fill in the blank. The silent flight of owls helps them to hunt because _____ cannot hear them coming, and the owl can _____ their prey as they fly toward it.

Concluding Questions/Assessment

*Student worksheet included in packet.

1. What is different about the flying abilities of a hummingbird compared to most other birds?
2. How does an owl's silent flight aid in its survival?
3. If you were a bird, what type of wing or flight style would you want and why?
4. Which of the options below best describes how lift is created for flight in birds?
    a. Air moving over the upper wing surface travels the same speed as air under the lower surface
    b. Air moving over the upper wing surface travels slower than air under the lower surface
    c. Air moving over the upper wing surface travels faster than air under the lower surface
5. Label the diagram below describing the forces of flight:
    a. Lift
    b. Drag
    c. Thrust