The Origin of Flight: What Use Is Half a Wing?

hhmi | BioInteractive

Scientists at Work
Student Worksheet

OVERVIEW

This worksheet complements the short video "The Origin of Flight: What Use Is Half a Wing?" from the *Scientists at Work* series.

PROCEDURE

1. Prior to watching the film, read the questions below.
2. Watch the film.
3. If working with a partner or in a small group, discuss and answer the questions below. If working alone, think about and answer the questions below.

QUESTIONS

1. What does the fossil record tell us about the evolutionary history of birds?
    a. What extinct animals did living birds descend from? _____

    b. Describe some of the characteristics that living birds share with these ancestors.

    c. What can living birds do that their early ancestors could not do? _____

2. What does Dr. Ken Dial study at the University of Montana? _____

3. Science is a social process in which scientists challenge each other's claims and share ideas and information. Explain how each of the following ideas contributed to the scientific process of learning about the evolution of flight.
    a. George Jackson Mivart challenges Charles Darwin's hypothesis that birds' wings formed from forelimbs through a series of intermediate transitional forms. In your own words, explain what was Mivart's question to Darwin.

    b. Dr. Dial wanted to observe how young birds used their immature wings as they learned to fly. How did a rancher familiar with the birds Dr. Dial was using in his studies help with the experiment?

    c. This modification led to an interesting observation. Describe what Dr. Dial's son Terry observed and shared with his father regarding the birds' behavior.

4. Dr. Dial and his son designed an experiment to further explore this initial observation.
   a. What was the purpose of the experiment?

   b. In the chart below, record observations of the birds' behavior during the experiment.

Log Position	**Describe the bird's behavior** (focus on use of legs and wings)
Low Angle	
Medium Angle	
Steepest Angle (Vertical, like a tree)	

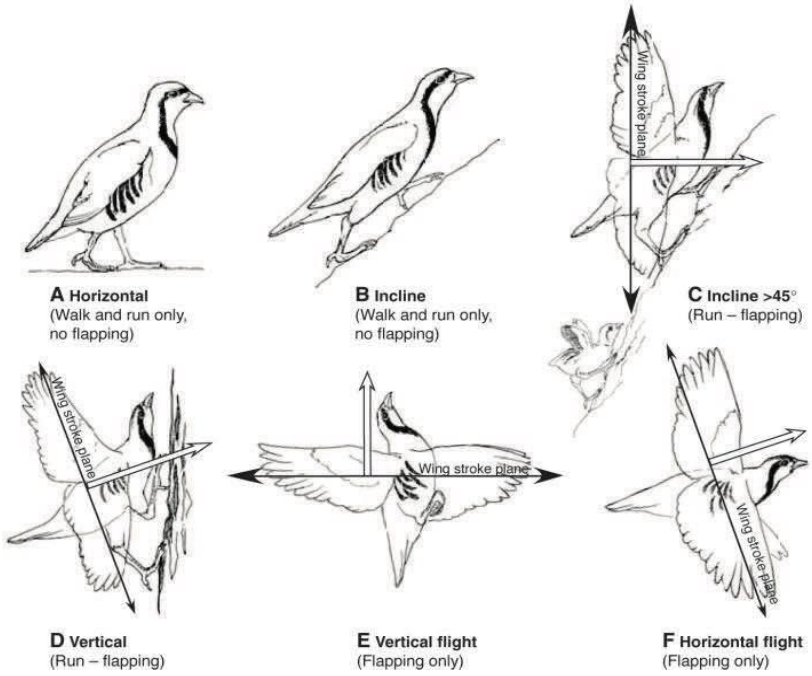

Figure 1. Overview of wing movement as birds run up increasingly steep inclines or fly. The narrow arrows indicate the wing stroke plane; the thick arrows show the direction of movement. In panels A and B, birds don't use their wings. In panels C and D, birds use their wings to assist them in running up an incline. In panels E and F, the birds are flying. (Source: *Science* vol. 299, 2003)

   c. Figure 1 is an illustration from one of Dr. Dial's publications. Examine the figure and describe the role of the wings in the bird's movement as illustrated in panels C and D.

d. How is that different from the role of the wings in panels E and F?

e. Were the observations Dr. Dial made in his experiment replicable? (i.e., has Dr. Dial seen this same behavior in other bird species and birds in the wild?)

f. What additional observation has Dr. Dial made in water birds?

g. How did technology enhance Dr. Dial's ability to observe the birds' climbing behavior?

5. Science is a process in which experimentation and observation are used to collect evidence to support ideas about how aspects of the natural world operate. Dr. Julia Clarke asks Dr. Dial how his observations change how we think flight evolved. What is Dr. Dial's explanation?

6. Describe the two competing traditional hypotheses regarding how flight evolved in dinosaurs.
   - *"Trees down"*:
   - *"Ground up"*:

7. What is a third hypothesis supported by Dr. Dial's research?

8. Explain how young birds learning to fly provide insights into how bird flight evolved.

9. Describe the selective pressure on early wings in juvenile theropod dinosaurs.