

RESOURCE LIBRARY  
ACTIVITY : 45 MINS

## Observations and Hypotheses

Students differentiate between observations and hypotheses in an article about pterosaurs. They then consider how challenging and further testing hypotheses is part of the nature of science.

### GRADES

6 - 12+

### SUBJECTS

*Biology, Geology*

### CONTENTS

2 PDFs, 3 Links

## OVERVIEW

Students differentiate between observations and hypotheses in an article about pterosaurs. They then consider how challenging and further testing hypotheses is part of the nature of science.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/observations-and-hypotheses/>

## Program



## DIRECTIONS

**1. Introduce the concepts of observation and hypothesis.**

Ask students to describe the weather in their community today. Guide them to include aspects of the weather that they can see with their eyes, such as cloud cover or sunlight, or that can be measured, such as temperature or humidity. List their ideas on the board, labeling them “observations.” Next, challenge them to give an explanation for why the weather is the way it is. Students might say that high temperatures are directly related to the tilt of the Earth and the angle of the sun against it where they live. List their ideas and label these “hypotheses.” Discuss the difference between an observation and a hypothesis. Help students recognize that identifying a hypothesis in an article tells you something about how to think about that statement more critically. Because it isn't an observation, the reader needs to investigate whether or not the hypothesis was supported by observations. Explain that for this activity, students will analyze an article about pterosaurs and consider how observations and hypotheses are part of constantly changing scientific study. Distribute the worksheet Observations and Hypotheses to pairs of students and review the definitions below the instructions. Look again at the “hypotheses” students made about the weather, and discuss whether those hypotheses are testable, stressing the importance of this step with any hypothesis.

## **2. Consider the challenges of research in paleontology.**

*Ask: What factors make it difficult for paleontologists to make observations or collect information?* (Most organisms that they study are extinct and cannot be observed alive today; many organisms are known only from incomplete specimens; most fossils only preserve the hard parts of an organism, such as shells, bones or woody material.) Explain that despite these factors, paleontologists, like any scientists, come up with hypotheses to explain evidence or observations.

## **3. Analyze the observations and hypotheses in the article.**

Have students read the April, 2009, *National Geographic News* article “Giant Pterosaurs Couldn't Fly, Study Suggests,” either online or with printed copies. Have them use content from the article and their understanding of observations and hypotheses to answer the

questions.

# Informal Assessment

Use the provided answer key to check students' completed worksheets. Make sure they understand the difference between observations and hypotheses and can correctly identify each.

## Extending the Learning

Have students read online the *National Geographic* article, "Pterosaurs—Lord of the Skies," or *National Geographic News*, "Pterosaur's Wing, 'Hairs' Unlike Any Living Animals." Ask them to look for additional pterosaur observations and hypotheses. Have students find other areas of debate around current research in paleontology.

## OBJECTIVES

## Subjects & Disciplines

**Biology**

**Earth Science**

- Geology

## Learning Objectives

Students will:

- differentiate between an observation and a hypothesis and apply that understanding to new information
- explain that scientists constantly challenge hypotheses, which can force them to make more observations and collect more data, helping them to reject some hypotheses and further strengthen others

## Teaching Approach

- Learning-for-use

# Teaching Methods

- Discussions
- Multimedia instruction
- Reading
- Research

## Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills
    - Critical Thinking and Problem Solving
- Critical Thinking Skills
  - Analyzing
  - Evaluating

## National Standards, Principles, and Practices

### NATIONAL SCIENCE EDUCATION STANDARDS

- (5-8) Standard C-5:

Diversity and adaptations of organisms

- (5-8) Standard G-2:

Nature of science

- (9-12) Standard C-3:

Biological evolution

- (9-12) Standard G-2:

Nature of scientific knowledge

### Preparation

### What You'll Need

### MATERIALS YOU PROVIDE

- Pencils
- Pens

## REQUIRED TECHNOLOGY

- Internet Access: Optional
- Tech Setup: 1 computer per small group

## PHYSICAL SPACE

- Classroom

## GROUPING

- Large-group instruction

## BACKGROUND & VOCABULARY

### Background Information

Paleontologists rely on fossil evidence to establish theories about species that existed on Earth millions of years ago. As part of developing a theory, they observe fossils that they find. For example, they measure a part of the specimen, describe what it looks like, and compare it to other specimens. Scientists also establish hypotheses about the significance of the observations, such as a statement that explains why the organism had the observed feature, or ways that the organism used the feature.

Early pterosaurs lived up to 215 million years ago. Pterosaur skeletons were likely air-filled, and their bones were unusually thin and fragile. These are two of the reasons pterosaur fossils are difficult to find, limiting the evidence available to scientists. As new discoveries are made, technology developed, and hypotheses supported, the body of information about pterosaurs grows and changes.

### Prior Knowledge

# Recommended Prior Activities

- [Adaptations: Changes Through Time](#)

## Vocabulary

Term	Part of Speech	Definition
adapt	verb	to adjust to new surroundings or a new situation.
evolve	verb	to develop new characteristics based on adaptation and natural selection.
hypothesis	noun	statement or suggestion that explains certain questions about certain facts. A hypothesis is tested to determine if it is accurate.
observation	noun	something that is learned from watching and measuring an object or pattern.

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### For Further Exploration

#### Articles & Profiles

- [National Geographic News: Giant Pterosaurs Couldn't Fly, Study Suggests](#)

#### Websites

- [National Geographic News: Pterosaur's Wing, 'Hairs' Unlike Any Living Animals](#)
- [National Geographic Magazine: Pterosaurs: Lords of the Ancient Skies](#)
- [National Geographic Entertainment: Flying Monsters 3D](#)

