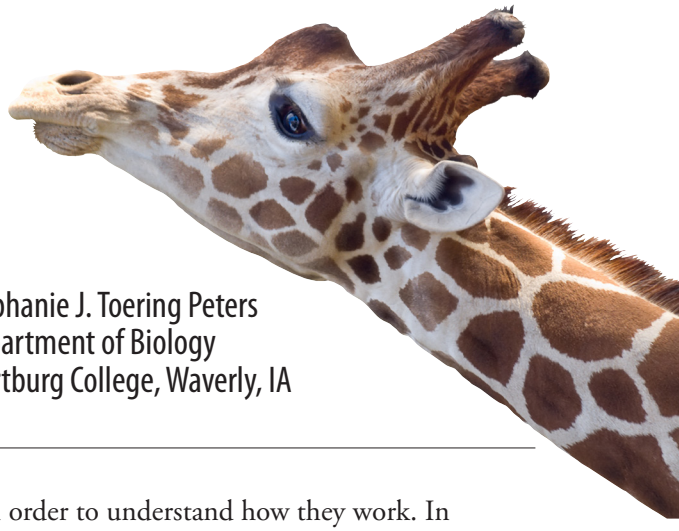
Winning by a Neck: *A Case Study in the Scientific Process*



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Science is a way of asking questions about the phenomena around us in order to understand how they work. In general, a scientific investigation will follow a typical pattern as outlined below.

Stages of a Scientific Investigation

1. *Observation:* A scientist (or group of scientists) observes a particular phenomenon, and wants to understand why that phenomenon occurs. The scientists develop questions related to the phenomenon that will help them understand it.
2. *Hypothesis development:* The scientist develops potential explanations or possible answers to the proposed questions related to the phenomenon. A scientific hypothesis must be testable and falsifiable. This means you can do an experiment to test the hypothesis, and the results from the experiment can show whether your hypothesis is supported or not.
3. *Design a scientific study:* The scientist designs experiments or plans observations to test the hypothesis.
4. *Make predictions:* The scientist makes experimental predictions based on the hypothesis and performs the experiments.
5. *Collect data and draw conclusions:* If the predictions are met, then the hypothesis can be accepted, though more testing may be required. If the predictions are not met, then the hypothesis is rejected and the scientist will return to Step 2 and develop a new hypothesis.

This case study will guide you through a scientific investigation into the question: *Why do giraffes have long necks?*

Stage 1: Observation

Giraffes are the tallest animals on the planet, and this height comes primarily from a disproportionately long neck and legs. As a budding biologist, you are curious as to the evolutionary pressures that have given rise to the elongated neck structure in the giraffe.

Stage 2: Hypothesis Development

Write at least two potential hypotheses that explain why the giraffe is tall and/or has an elongated neck.

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This case is based on R.E. Simmons and L. Scheepers, "Winning by a neck: sexual selection in the evolution of giraffe," *The American Naturalist* 148, no. 5 (1996): 771–786.

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As a class, develop a list of potential hypotheses. Your instructor will choose one for you to pursue further. Write the class hypothesis below.

Hypothesis 1:

Stage 3: Design a Scientific Study

How can you test this hypothesis?

Stage 4: Make Predictions

Your instructor will describe an experiment designed to test this hypothesis. What results do you expect from this experiment based on your hypothesis?

Stage 5: Collect Data and Draw Conclusions

Do the results from Experiment 1 support your hypothesis? Explain why or why not.

Stage 4: Make Predictions

Your instructor will describe a second experiment designed to test this hypothesis. What results do you expect from this experiment based on your hypothesis?

Stage 5: Collect Data and Draw Conclusions

Do the results from Experiment 2 support your hypothesis? Explain why or why not.

Stage 2: Hypothesis Development and Stage 3: Design a Scientific Study

While you were in the field observing feeding behavior, you noticed something interesting…

Based on the information shared by your instructor, develop a new hypothesis and propose an experiment to test it.

Write down the second hypothesis proposed by the class:

Hypothesis 2:

Stage 4: Make Predictions

Your instructor will describe an experiment designed to test the new hypothesis. What results do you expect from this experiment based on your hypothesis?

Stage 5: Collect Data and Draw Conclusions

Do the results from Experiment 3 support your hypothesis?

Now go back to the original question and answer it: *Why do giraffes have long necks?*

Summary Questions:

1. What have you learned about the scientific process in this exercise?

2. What is the role of experiments/observations in the process of science?

3. How does a hypothesis help move science forward, even if it is not supported by the evidence?