

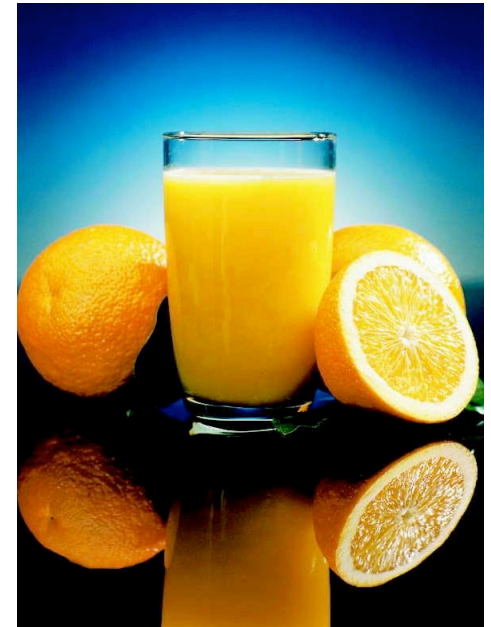
What is biology?

What is biology?

- Biology:
 - The science that studies living organisms
- What is science?
 - Process
 - A way of answering questions

What is science?

- A way of answering questions
The Scientific Method
- Step 1:
 - Observation
 - My friend drinks a lot of juice and doesn't often get colds.
 - Question
 - What if the vitamin C in orange juice helps prevent colds?



What is science?

- Step 1:
 - Observation
 - People who don't drink pop (soda) seem to have fewer heart attacks
 - Question
 - Is there an association between pop drinking and heart health?

What is science?

- Step 2:
 - Hypothesis
 - What is a hypothesis?
 - A hypothesis is
 - 1. A statement
 - 2. Testable
 - 3. Falsifiable

What is science?

- Step 2:
 - Hypothesis
 - Consuming vitamin C reduces the risk of catching a cold.
 - Prediction
 - IF we give people lots of vitamin C, THEN they should get fewer colds than people without vitamin C.

What is science?

- Step 2:
 - Hypothesis:
 - Drinking pop increases your risk of heart disease.
 - Prediction:
 - IF someone drinks pop, THEN they are more likely to show symptoms of heart disease.

What is science?

- Step 3:
 - Experiment
 - Situations designed to test specific ideas.
 - May be manipulated situations
 - » Controlled experiments
 - May be careful observations
 - » Naturalistic experiments
 - Results in data
 - Information that can be used to evaluate hypotheses

What is science?

- Step 3:
 - Experiment
 - Test the hypothesis: Consuming vitamin C reduces the risk of catching a cold.
 - How would you design your experiment to show that ONLY vitamin C has an effect?

What is science?

- Step 3:
 - Experiment
 - Test the hypothesis: Drinking pop increases your risk of heart disease.
 - How would you design your experiment to evaluate this hypothesis?
 - The researchers answering this question were taking data as part of a larger study. They had long-term data on the habits of >6000 people who did not have heart disease at the start of the data collection.

What is science?

- Step 4:
 - Evaluate the data
 - Do they support your hypothesis?
 - Do they disprove your hypothesis?
 - Do they lead to more questions?

What is science?

- Step 4:
 - Evaluate the data
 - People on vitamin C supplements have more colds than people without
 - Disproves hypothesis
 - People on vitamin C supplements have the same number of colds as people without
 - Disproves hypothesis
 - People on vitamin C supplements have fewer colds than people without
 - Supports hypothesis

What is science?

- Evaluate the data:
 - People on vitamin C supplements have fewer colds than those without
 - Supports hypothesis
 - Why doesn't it prove it to be true?
 - Alternative hypotheses
 - Different immune systems
 - Different diets
 - Different metabolism of vitamin C
 - People who take supplements more likely to exercise

What is science?

- Step 4:
 - Evaluate the data
 - Drinking pop increases your risk of heart disease
- Results
 - Individuals who consume pop are at higher risk for certain types of heart disease.
 - » What else might be affecting this risk?

What is science?

- Experimental controls
 - Variables that stay constant throughout all situations
 - If there are differences in different situations, it is NOT due to the controls
 - An experiment that is controlled is one that compares a baseline to a manipulated group.

What is science?

- Observation:
 - Chili peppers contain capsaicin- a chemical that makes them hot.
- Hypothesis
 - Directed dispersal hypothesis
 - Capsaicin deters seed predators, but not seed dispersers



Cactus mice are seed eaters.



Figure 1-10b Biological Science, 2/e

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Curve-billed thrashers eat chili fruits.



Figure 1-10c Biological Science, 2/e

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What is science?

- Directed Dispersal hypothesis
 - Mice and birds should respond differently to capsaicin
- Test
 - Present both with chiles
 - Present both with non-chiles

What is science?

- A process by which experiments are used to evaluate hypotheses.
- Hypotheses that are repeatedly tested and supported
 - Theories

Which of the following are good hypotheses?

- 1. People like Heinz ketchup better than Hunt's ketchup.
- 2. Why do birds fly south?
- 3. My car won't start because the battery is dead.
- 4. Stonehenge was built by magic.

How is science evaluated?

- Primary literature
 - Peer-reviewed
- Secondary literature
 - Subset of the primary literature
 - Interpreted
 - Affected by editorial decisions