Chapter 1
The Science of Biology

What is Science?

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What Science Is and Is Not

A. Science is NOT just a collection of never-changing facts.

B. Scientific ideas are open to testing, discussion, and revision.

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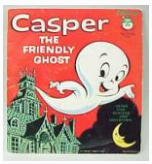
Science as a Way of Knowing

A. Science is a "way of knowing" about the world.
   1. Deals only with natural world.
   2. Scientists look for patterns and connections.
   3. Scientists propose explanations based on evidence, then test those explanations.
   4. The supernatural is outside the realm of science.



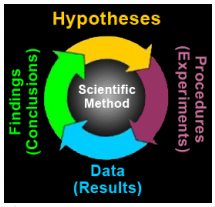
The Goals of Science

A. One goal of Science:
   1. **To provide natural explanations for natural events in the world.**
   2. Aristotle and other Greeks were first.
      a. Whereas ancient science attempted to explain the "why" of things, **modern science aims to answer the "how"** of things.

Scientific Methodology: The Heart of Science

A. We all use science in our thinking every day – e.g. car won't start…

B. There is not a specific "scientific method", only scientific methodology.



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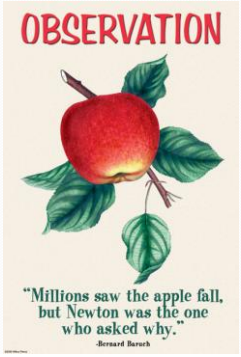

D. Observing and Asking Questions

1. Begins with **observation**, the act of noticing and describe events or processes in a careful, orderly way.

Scientific Methodology: The Heart of Science

E. Inferring and Forming a Hypothesis

1. After posing questions, scientists make **inferences**.
   a. Logical interpretations based on what is already known.
2. Inference can lead to a **hypothesis**
   a. A scientific explanation for a set of observations that can be tested in ways that support or reject it.

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Scientific Methodology: The Heart of Science

F. Designing Controlled Experiments

1. Keeps track of factors that can change or **variables**.
   a. Types of variables : Temperature, light, time, and availability of nutrients.
2. Only one variable should be changed, while all others remain unchanged.
   a. **Controlled experiment**.

Coyote using the Scientific Method

Scientific Methodology: The Heart of Science

G. Controlling Variables
   1. The variable that is deliberately changed - **independent variable**
      a. Manipulated variable
   2. The variable that is observed and that changes in response to the independent variable - **dependent variable**
      a. Responding variable

Scientific Methodology: The Heart of Science

I. Collecting and Analyzing Data
   1. Researchers collected two types of data:
      a. **Quantitative** data
         i. Numbers obtained by counting or measuring.
      b. **Qualitative** data
         ii. Descriptive and involve characteristics that cannot usually be counted.

Example 1:
Oil Painting

- **Qualitative data:**
- blue/green color, gold frame
- smells old and musty
- texture shows brush strokes of oil paint
- peaceful scene of the country
- masterful brush strokes

- **Quantitative data:**
- picture is 10" by 14"
- with frame 14" by 18"
- weighs 8.5 pounds
- surface area of painting is 140 sq. in.
- cost $300

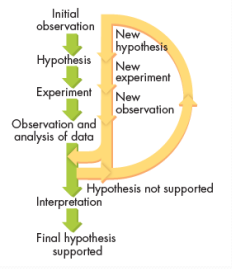
Scientific Methodology: The Heart of Science

J. Sources of Error
   1. Researchers must be careful to avoid errors in data collection and analysis.
   2. Tools can have limited accuracy.
   3. Sample size must be chosen carefully.
      a. Larger the sample size, the more reliable the results.

Drawing Conclusions

A. Scientists use experimental data as evidence to support, refute, or revise the hypothesis being tested, and to draw a valid conclusion.

B. Hypotheses may have to be revised and experiments redone several times before a final hypothesis is supported and conclusions can be drawn.



Something tells me you might not have quite what it takes to become an entomologist...
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