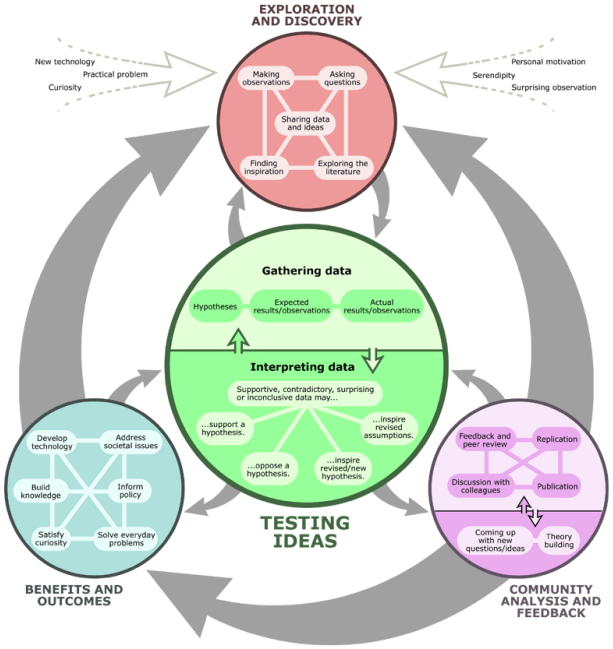


NOTES 1.4: THE SCIENTIFIC METHOD

Pages 13-19

Thinking Like a Scientist

- **Seeks to answer questions about the natural world**
- **Use the Scientific Method to test hypothesis**
- **Provides accurate, reliable answers to questions/problems**

Scientific Method

Scientific Method: a set of steps or procedures that you following when conducting an experiment

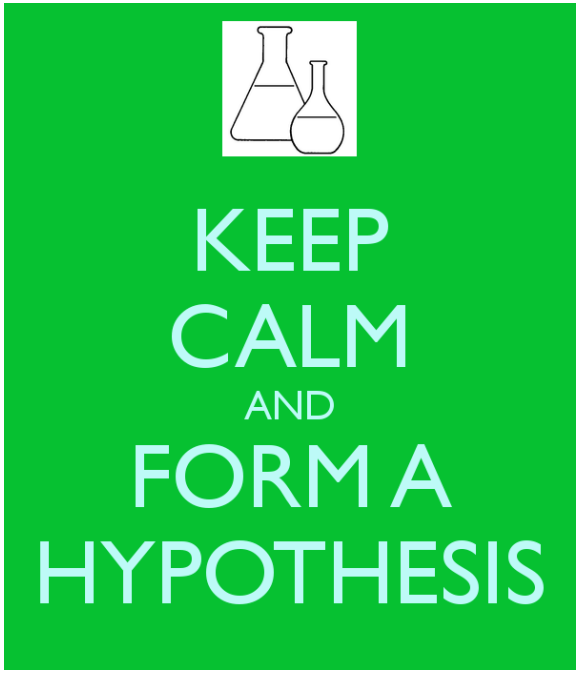
1. Making observations (think of a questior `
2. Formulate a hypothesis
3. Create a prediction
4. Design and conduct the experiment
5. Analyze data using graphics
6. Drawing conclusions
7. Communicating results
8. Retest

1. OBSERVATIONS

- **The process of gathering information about events or processes in a careful, orderly way**
- **Using our senses to make observations of the natural world**

HYPOTHESIS

- A hypothesis is a proposed scientific explanation for a set of observations
- Scientists generate hypotheses using prior knowledge, or what they already know
- This statement is testable and can be confirmed with experimentation or further observation



PREDICTION

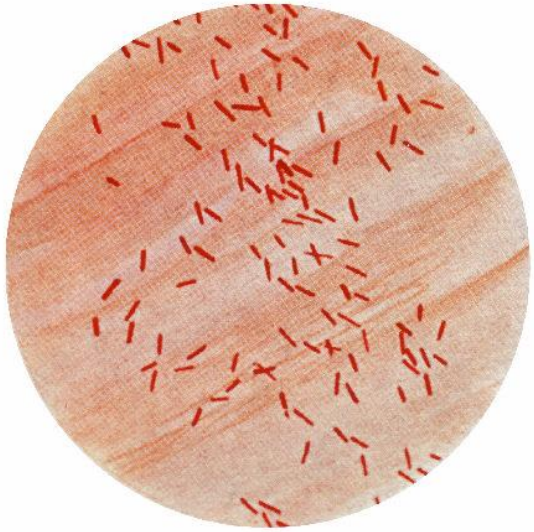
- A forecast as to what should happen during an experiment if your hypothesis is supported

- Written in an "If _____, then _____" statement

- <u>Example</u>
  - Hypothesis: Studying improves test scores.
  - Prediction: **If** I study, **then** I will improve my test scores.

Practice

- Observation: Several students get sick after eating a Big Mac at McDonald's.
- **Formulate a hypothesis**
- **Formulate a prediction based on the hypothesis**



EXPERIMENT

- Designing an activity/experiment to test a hypothesis under controlled conditions

- A good experiment can be replicated by other scientists and the same results can be obtained

EXPERIMENT …contd.
Controls and Variables

- **<u>Controlled Experiment</u>:** Has a control group and an experimental group differing by only one factor (variable)
  - **Control Group:** Not being tested. Used for comparison only.
  - **Experimental Group**: Group being tested. Differs by the control group by only one factor.
  - **Constants**: factors kept the same for the control and experimental group. Ensures results seen are due only to the factor being tested.

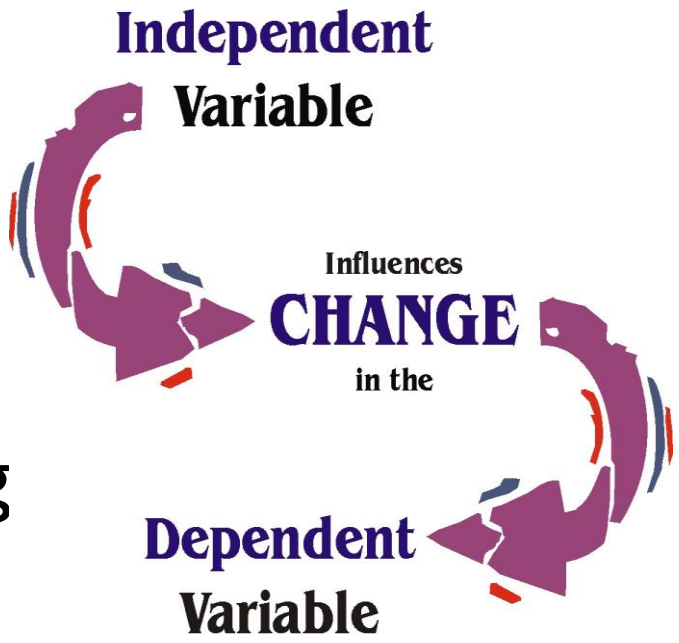
EXPERIMENT …contd.
Controls and Variables

- Ex. When testing the effects of fertilizer on fruit production, everything would stay the same between two groups of plants (water, sunlight exposure, amount of fertilizer etc). They only difference is the type of fertilizer.

EXPERIMENT …contd.
Controls and Variables

- **Independent Variable (cause)**: Factor scientists change or manipulate

- **Dependent Variable (effect):** Factor that is being measured or observed, changes as independent variable changes



Practice

- Suppose you want to figure out the fastest route to walk home from school.

- You will try several different routes and time how long it takes you to get home by each one.

- Dependent variable: _____
- Independent variable: _____
- Constants: _____

DATA ANALYSIS

- Two main categories of data: Quantitative and Qualitative.

- **Quantitative data** are expressed as numbers, obtained by counting or measuring.

- **Qualitative data** are descriptive and involve characteristics that can't usually be counted. Ex. "the scar appears old" and "the animal seems healthy and alert."

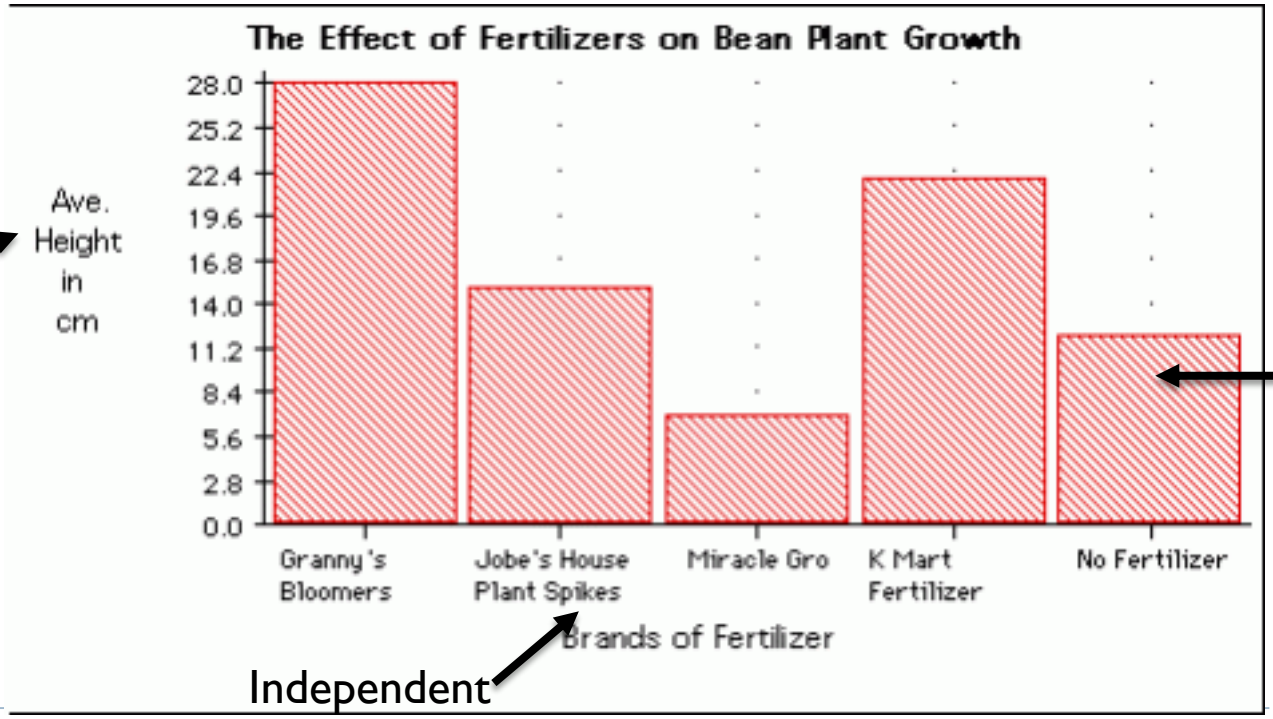
Quantitative or Qualitative?

Quantitative or Qualitative?

DATA ANALYSIS

- Organize data in tables and charts

- Create graphs



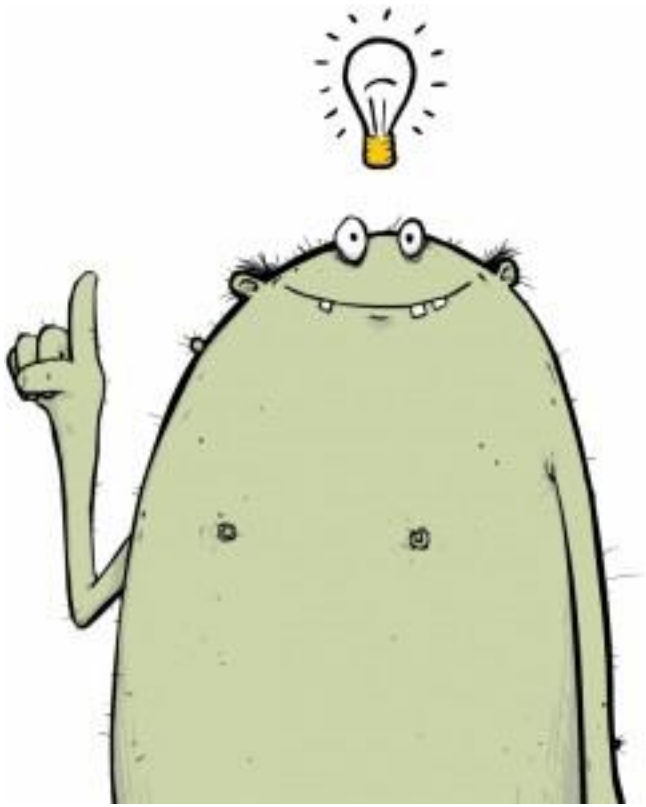
Dependent Variable

Control

Independent Variable

CONCLUSION

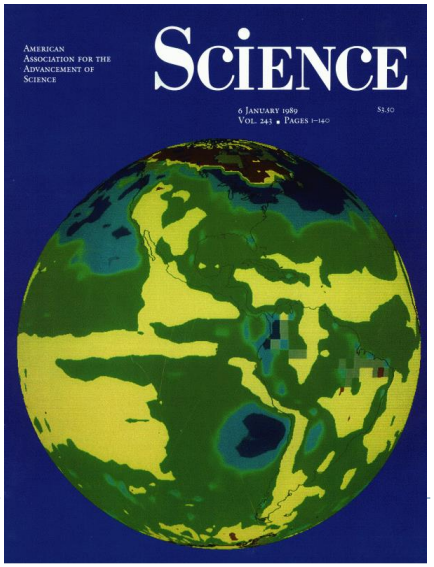
- Explain data and results
- Support or reject your hypothesis
- Summarize experiment and form new questions



COMMUNICATE

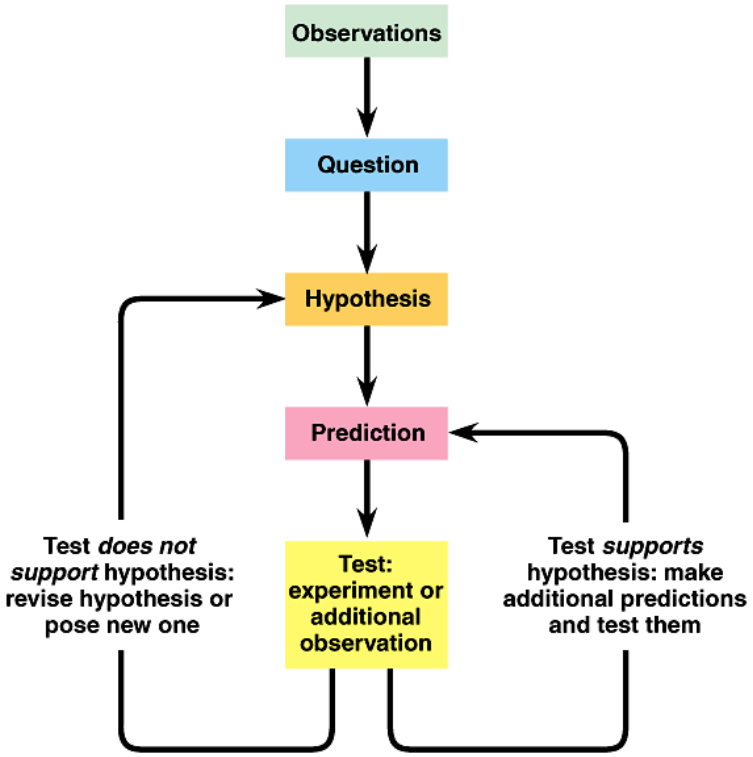
- Share your results with other scientists

- A scientific article must tell the reader what the question to be answered is, why the question is important, background information, a description of the experiment, the data that were collected, and the scientist's evaluation of what the data mean.



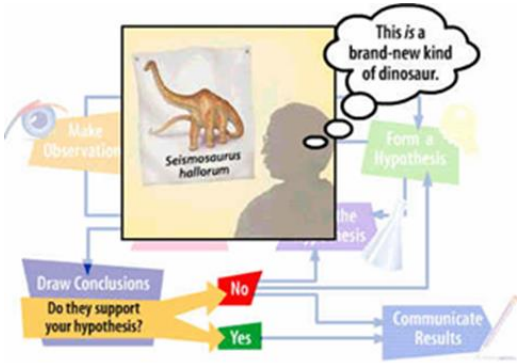
RETEST

- **Test DOES NOT support hypothesis?**
  - Revise hypothesis or create a new one
- **Test DOES supports hypothesis?**
  - Create new predictions and test them
  - After further support from various experiments then the hypothesis may become a theory



Theory

- THEORY: formed from repeated observation, testing of related hypotheses, and is supported with much evidence



- Describes the why and how something happens

- Examples: cell theory and the theory of evolution
  - The saying "it's just a theory" makes it sound untested, but these theories have been well tested

Law

- A statement of fact that concisely explains an action or group of actions, tells us what something will do
  e.g. Law of Gravity
- Accepted to be true
- Universal
- May be expressed as a math equation
  e.g. $E=mc^2$

Homework

Vocabulary Word	Definition	Picture/Symbol/ Example
Experimental Group		
Control Group		
Constant		
Quantitative Data		
Qualitative Data