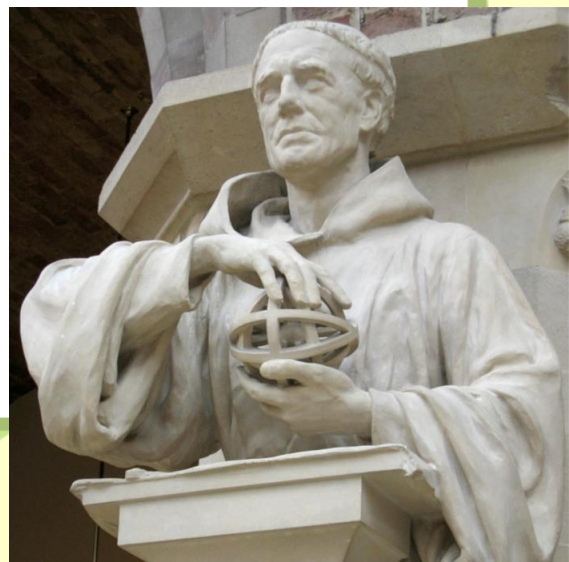
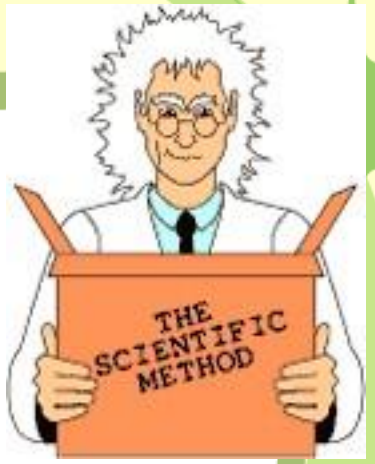
Scientific Methods Review

Science's First Advocate

- Roger Bacon (1220-1292)
  - English philosopher and educational reformer
  - Major contributor to our current model of the scientific method
  - He emphasized using inquiry to answer questions in science
- **Inquiry:** a seeking request for information or knowledge



Scientific Methods



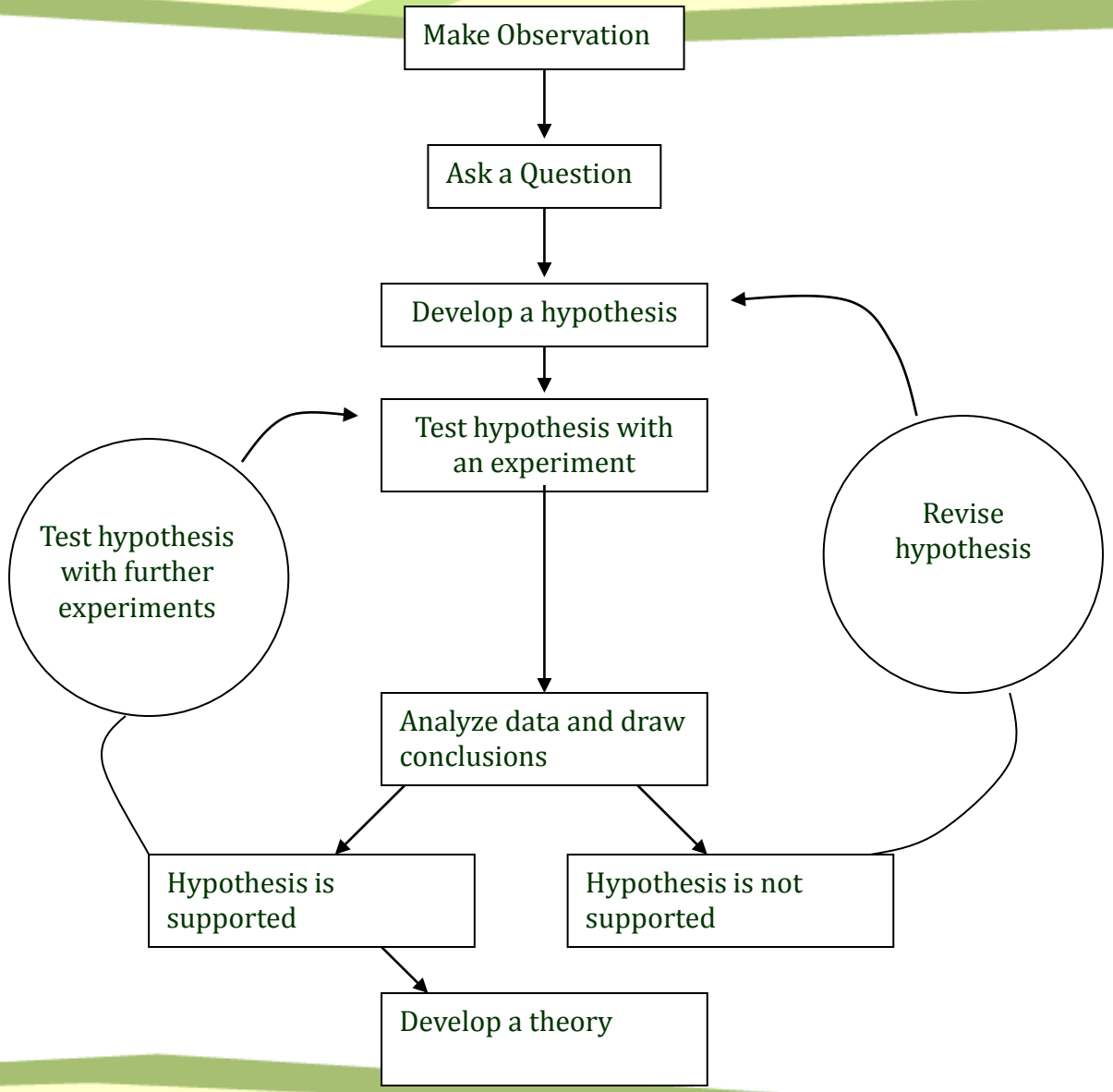
- Need information to answer questions
- Scientific method: an organized plan for gathering, organizing, and communicating information
- Goal:
  - Solve a problem
  - Better understand an event
- It can be used by **anyone**!! All you need is a reason to use it!

Why do we need a method?

- To ensure reliable research/results
- To communicate results clearly

More than One Way…

- Your pink handout shows **one example** of a scientific method that we are going to use in our class.
- However, **scientific methods can vary** from case to case. One person might follow different steps in different orders.
- **There is not one single correct way**


Make Observation
Ask a Question
Develop a hypothesis
Test hypothesis with an experiment
Test hypothesis with further experiments
Revise hypothesis
Analyze data and draw conclusions
Hypothesis is supported
Hypothesis is not supported
Develop a theory

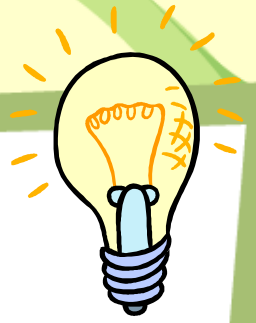
Making Observations

- **<u>Observation:</u>** information that you obtain through your senses.
- You combine observations into a question

Asking a Question

- Based on your observations, ask a question
- Must be something you can answer by conducting an experiment

Forming a Hypothesis



- Hypothesis: a proposed answer to a question.
  - Prediction
- **Remember to include your variables in an "If…then…" statement**
- *Ex) "**If the same** amount of water and soil are given to the same pea under natural and sunlight**, then** the natural light will produce taller peas than sunlight."*
- No "I think…" It's not about you!

Data Collection

- Experiments test a hypothesis
- Experiments must collect some type of data
  - Qualitative Data
  - Quantitative Data

Types of Data

- **<u>Qualitative Data:</u>** any information that uses words to describe your data
  - Ex: the clothes changed from green to blue
- **<u>Quantitative Data</u>**: any information that is expressed in numbers or measured
  - Ex: the amount of water you accumulate in the rain is 400 liters

Uh Oh…

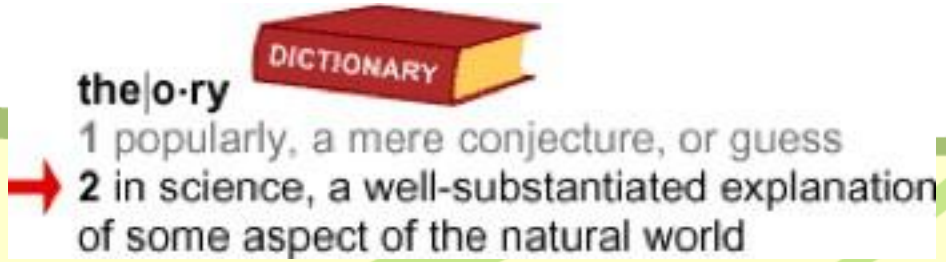
- What happens when the data doesn't support our hypothesis?
- Two Choices:
  1. revise our first hypothesis or
  2. propose a new hypothesis based on the data from our initial experiment.
- A new experiment must then be designed to test our new hypothesis!

Drawing Conclusions

- This is where you discuss if your hypothesis was **supported** or **not supported** (rejected) using **DATA**
- **Explain the data** that you include in your report
- Discuss possible sources of error and how you would revise your experiment if done again.
- Always write conclusions in 3rd person

Developing a Theory

- **Scientific theory**: well-tested explanation for a set of observations or experimental results.
  - Tries to explain **HOW** things happen
- Theories are **NEVER proved**.
  - stronger when more facts support them, or
  - revised or replaced when it fails to explain new facts and discoveries.



Scientific Laws

- **Scientific Law:** a statement that summarizes a pattern found in nature
  - Ex: Newton's Law of Gravity
- *Does not* attempt to *explain how* that pattern happens. (That's a theory!)
  - Scientists have yet to agree on a theory that explains *how* gravity works!