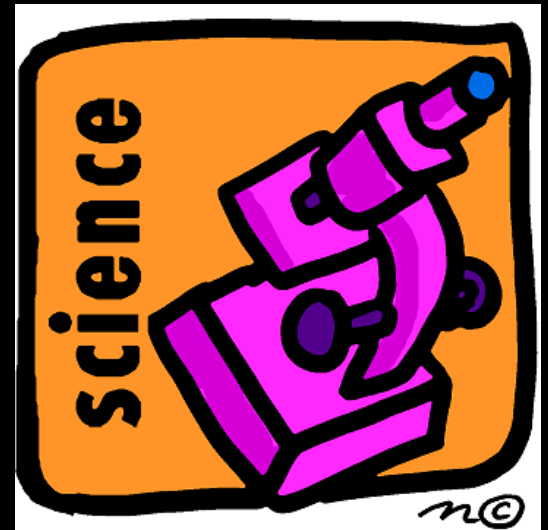


# Scientific Inquiry

Standards B – 1.4 & 1.6

# Standard B-1

The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.



B-1.4

Design a scientific investigation with appropriate methods of control to test a hypothesis, and evaluate the designs of sample investigations.

B-1.6

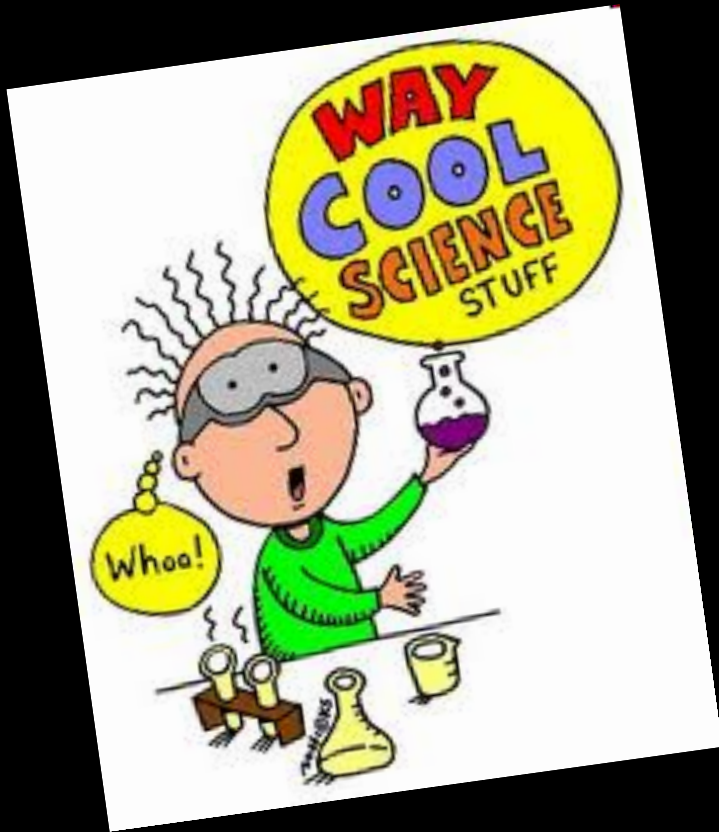
Evaluate the results of a controlled scientific investigation in terms of whether they refute or verify the hypothesis.

# Key Concepts

- Scientific Investigations
- Methods of Control in Scientific Investigations

# What You Already Know!

Since the *4<sup>th</sup> grade*, you have been studying the characteristics of a simple scientific investigation that tests one manipulated variable at a time. By middle school, you were designing and evaluating your own scientific investigations.



# What You Should Understand After This Lesson

- Design a controlled scientific investigation in which one variable at a time is deliberately changed and the effect on another variable is observed while holding all other variables constant. This relationship is a “cause-and-effect” relationship.
- Understand the parts of a scientific investigation and the importance of communicating results.

# Objective

- ***Classify*** the types of variables and constants in a controlled investigation.
- ***Summarize*** the components of a controlled scientific investigation.
- ***Interpret*** the data of a scientific investigation to determine if the conclusion is valid.

# Vocabulary

1. Observation
2. Data
3. Experiment
4. Constant
5. Theory



# Scientific Thinking

Biologists ask questions about the world around them and use observation and experimentation to answer questions about it.





# Scientific Thinking

A good biologist is:

- Skeptical
- Curious
- Open-minded
- Accepting of new ideas



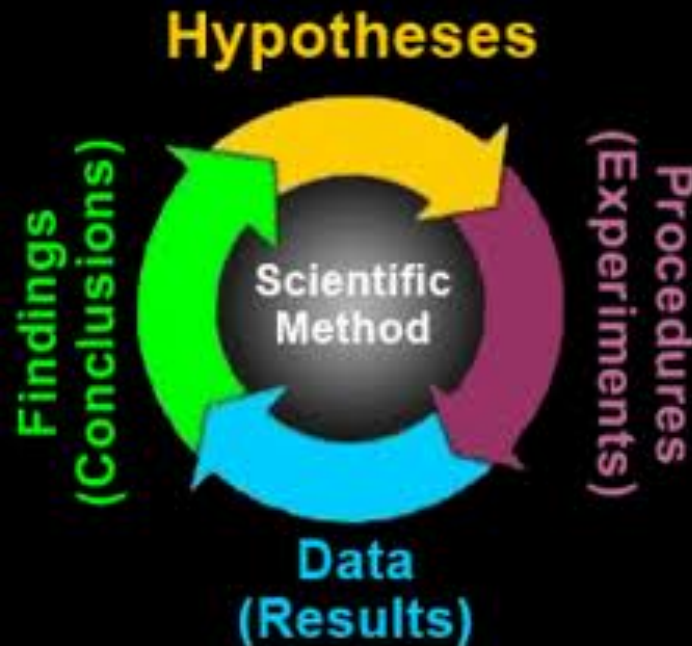
# The Scientific Method

The Scientific Method is used in order to help scientists solve problems and answer questions. It is a precise way of conducting an investigation which will give the best results.



# The Scientific Method

Biology is an empirical science  
Deals with the NATURAL WORLD



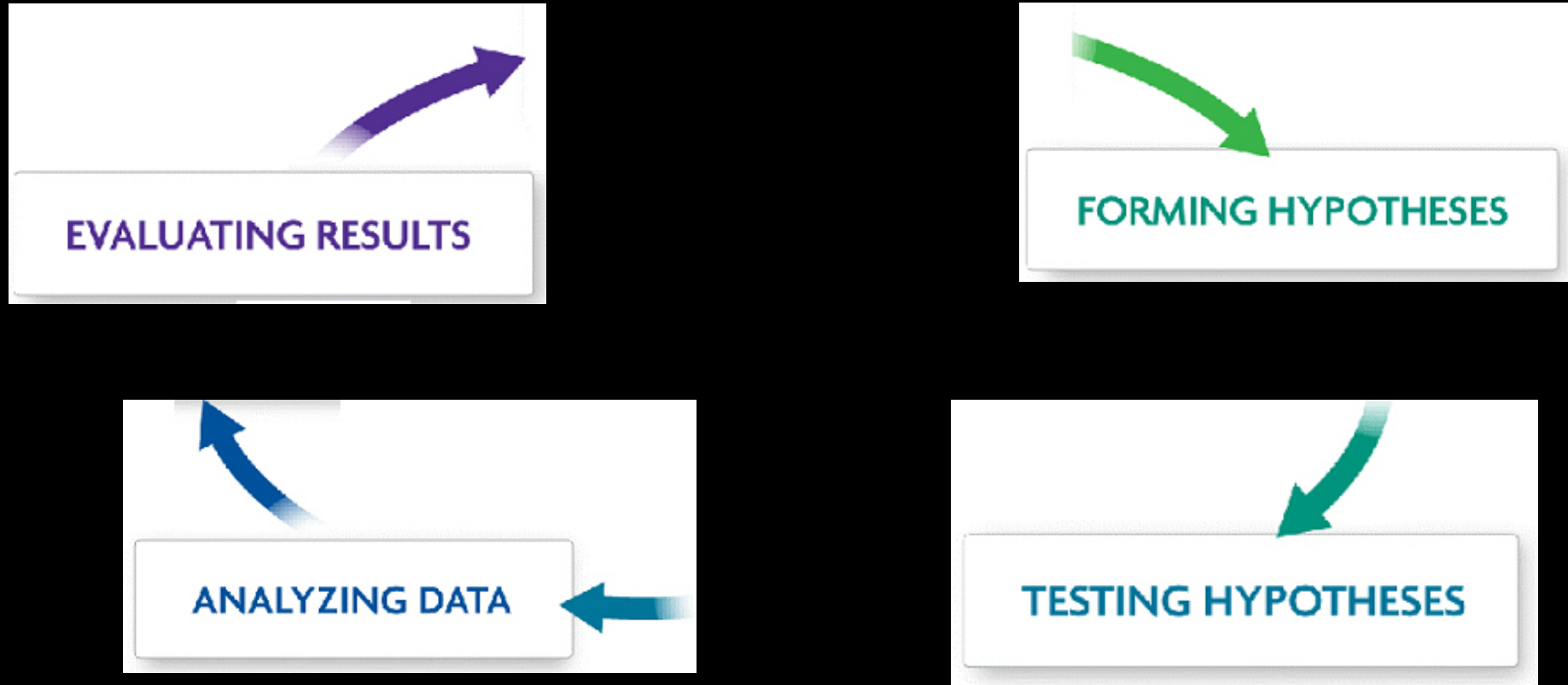
**OBSERVING**

**EVALUATING RESULTS**

**FORMING HYPOTHESES**

**ANALYZING DATA**

**TESTING HYPOTHESES**



# Scientific Thinking & Processes

## Parts of the Scientific Method:

1. Observation (*Data Collection*)
2. Forming hypotheses (*Educated Guess*)
3. Testing hypotheses (*Experiment*)
4. Analyzing Data (*Results*)
5. Evaluating Results (*Drawing Conclusions*)

Observational studies allow scientists to describe a phenomenon.



# Scientific Thinking & Processes

## Observation

- All scientific inquiry begins with observation.
- Cannot be biased; has to be fair.
- Using one or more of the 5 senses to collect, describe, and categorize data.
  - Quantitative or Qualitative Data
- Using computers to collect measurements or examine past research observations.

# Scientific Thinking & Processes

## *Quantitative Data*

- Number
  - 12 cm long
  - 3 elephants
  - Twenty four grams
- Represented via some type of graph

## *Qualitative Data*

- Words/Description
  - The tiger is orange and black.
  - The gorilla is not an aggressive animal unless provoked.
- Represented via some type of chart/table or notes.



# Scientific Thinking & Processes

## Forming Hypotheses

- Preliminary possible explanation of data; an educated guess
- Hypotheses help scientists find answers to questions



# Scientific Thinking & Processes

## Testing Hypotheses

- Conducting an experiment
- Shows a cause and effect relationship
- Tests 1 variable at a time.
- IV, DV, CG, and Constants



# Variable Identification

**PRACTICE**  
makes  
**PROGRESS,**  
**NOT**  
**PERFECT.**

# Scientific Thinking & Processes

## Analyzing Data

- Statistics plays a role
- Construct charts, tables, graphs, plots, models, etc.



# Scientific Thinking & Processes

## Evaluating Data

- Occurs after analysis
- Drawing conclusions
- Can lead to theories
- May publish their results for others.

