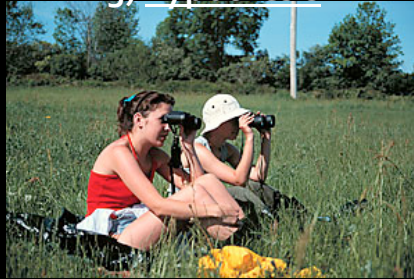


Often investigations begin after  
1) observations lead to 2) questions and the formation of a  
3) hypothesis



III. Hypothesis - a clear statement of what you think the outcome will be. This should be based on observations and what you know. It also has to be testable. It may be tested by an experiment.

## IV. Procedure - A detailed list of steps of what you did.

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1. They should be numbered or bulleted.
  2. Detailed step by step.
  3. Another person should be able to read your procedure and repeat the experiment perfectly.
-

## V. Experiment

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- Whenever possible, scientists try to carry out a controlled experiment. A controlled experiment tests only one factor at a time.

There are two parts to an experiment

control group – the standard against which results are compared. It does not receive the experimental variable.

experimental group – does receive the variable being tested.

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## Variables

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- A variable is any factor(s) or condition which may affect the outcome of an experiment
    - Independent variable (IV)– A variable that is specified first (known ahead of time); the variable being tested
    - Dependent variable (DV) – variable watched or measured to collect data; changes as a result of the independent variable
    - Controlled (constant) variables – all other variables kept constant, otherwise they would affect the results
-

## 3 Kinds of Variables

### Independent Variable (IV)

- something that is intentionally changed by the scientist
  - What is being tested
  - It is known ahead of time
  - What are you changing or manipulating
  - You can only change ONE variable in an experiment!!!

## 3 Kinds of Variables

### Dependent Variable (DV)

- something that might be affected by the change in the independent variable
  - What is *observed and measured*
  - The data collected during the investigation
  - Independent variable may change the dependent variable

## 3 Kinds of Variables

### Controlled Variable (CV)

– a variable that is not changed and kept the same

- Also called constants
- Allows for a “fair test”
- **NOT** the same as a “control”!!
- Any given experiment will have many controlled variables

Here are some different examples:

Students of different ages were given the same jigsaw puzzle to put together.

They were timed to see how long it took to finish the puzzle.

Identify the variables in this investigation!

What was the independent variable?

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Ages of the students

- Different ages were tested by the scientist
- 

What was the dependent variable?

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The time it to put the puzzle together

- The time was observed and measured by the scientist
-

## What was a controlled variable?

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### Same puzzle

- All of the participants were tested with the **same** puzzle.
  - It would not have been a fair test if some had an easy 30 piece puzzle and some had a harder 500 piece puzzle.
- 

## Independent or Dependent?

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- Identify the Independent and Dependent Variables below
  - number of rats                      rat poison
  - night or day                          plant growth in cm
  - students grade                      amount of sleep
  - age of drivers                      cost of car insurance
  - weight of a person                  calorie intake
  - grade in science class              % of H.W. done
-

## VI. Data -must be collected. Data may be:

- Qualitative (descriptive)
  - The cute, fuzzy, tan colored lion has sharp teeth and a long tail.
- Quantitative (numbers)
  - The 500 kg lion has 6 cm long claws at the end of each of its 18 toes.



## Data

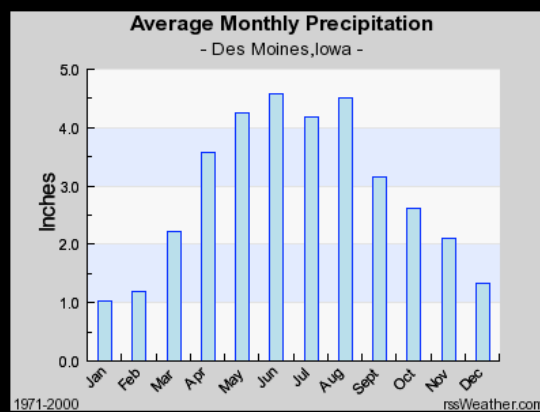
List of observations

Tables

Graphs

Charts

Descriptions





# Representing Quantitative Data

## Independent Variable

- Graphed on the x-axis
- The first column of a data table

## Dependent Variable

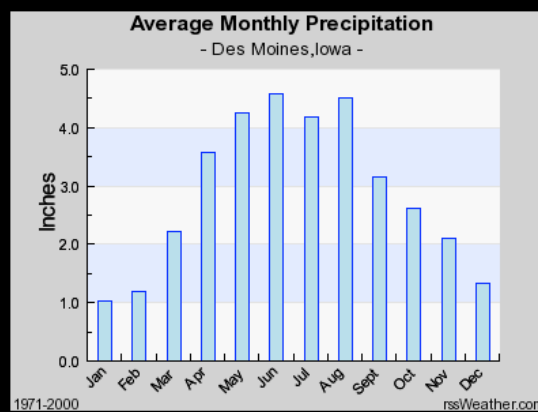
- Graphed on the y-axis
- All of the columns to the right of the first column on a data table

## VII. Data Analysis: once the data has been gathered it needs to be analysis or interpreted.

What does the data say?

There is more rain fall in the summer months.  
The most was in June  
The least was in Jan.  
There is less in the winter.

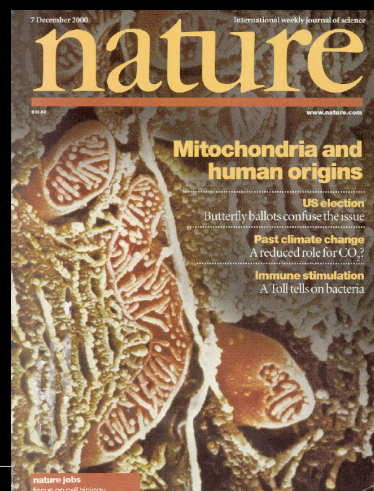
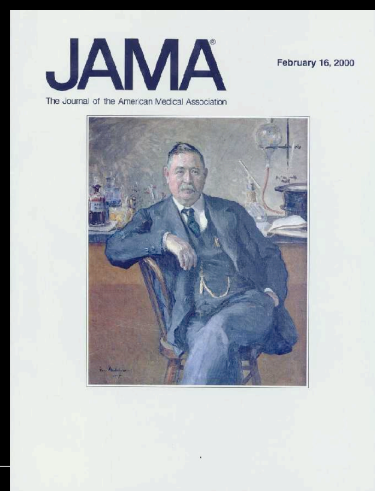
The data analysis is what the data shows or tells you.



## VIII. Conclusion — Conclusions explain your observations and describe how your data relates to the problem.

- It is **written in paragraph/essay form** and should include why you did this experiment (**restate the purpose/problem**).
- You should explain in your own **words what you found out or discovered**.
- Your conclusion should state whether or not the **data confirms or rejects your hypothesis**.
- **Discuss any errors or problems** as well as any patterns you see.
- Part of the conclusion may be a **new hypothesis** based on your findings.

## IX. Publish: (communicates) the results



## Review

### **A. Scientific Methods**

1. Observe
2. Question
3. Form a hypothesis
4. Design an experiment
5. Collect Data
6. Analyze Data
7. Form a conclusion
8. Communicate your results

**B. Experiments can either be controlled  
or done in the field**

Let's apply!

- Five tomato plants of the same height were placed in the same size pots, in the same type of soil and each was given the same amount of water. Each plant was under a light bulb of the same intensity as the others but each light was of a different color. Each day, the plants were given light (each its own color) for 12 hours and left in darkness for 12 hours. The height of each plant was measured in centimeters at the end of each week for 10 weeks.

Week # →		1	2	3	4	5	6	7	8	9	10
Height (cm)	Yellow	4	5	6	7	8	9	10	11	12	13
	Green	4	4	4	3	3	2	2	1	0	0
	Blue	4	4	4	5	5	5	5	6	6	6
	Purple	4	4	5	5	6	6	7	7	8	8
	Red	4	5	6	7	8	9	10	11	12	13

- Five tomato plants of the same height were placed in the same size pots, in the same type of soil and each was given the same amount of water. Each plant was under a light bulb of the same intensity as the others but each light was of a different color. Each day, the plants were given light (each its own color) for 12 hours and left in darkness for 12 hours. The height of each plant was measured in centimeters at the end of each week for 10 weeks.
- What question is tested by this experiment?

- Five tomato plants of the same height were placed in the same size pots, in the same type of soil and each was given the same amount of water. Each plant was under a light bulb of the same intensity as the others but each light was of a different color. Each day, the plants were given light (each its own color) for 12 hours and left in darkness for 12 hours. The height of each plant was measured in centimeters at the end of each week for 10 weeks.
- What is a possible hypothesis for this experiment?

- Five tomato plants of the same height were placed in the same size pots, in the same type of soil and each was given the same amount of water. Each plant was under a light bulb of the same intensity as the others but each light was of a different color. Each day, the plants were given light (each its own color) for 12 hours and left in darkness for 12 hours. The height of each plant was measured in centimeters at the end of each week for 10 weeks.
- What is the independent variable?
- What is the dependent variable?

- Five tomato plants of the same height were placed in the same size pots, in the same type of soil and each was given the same amount of water. Each plant was under a light bulb of the same intensity as the others but each light was of a different color. Each day, the plants were given light (each its own color) for 12 hours and left in darkness for 12 hours. The height of each plant was measured in centimeters at the end of each week for 10 weeks.
- What are the controlled variables? (What factors are held constant in the experiment? )

- Five tomato plants of the same height were placed in the same size pots, in the same type of soil and each was given the same amount of water. Each plant was under a light bulb of the same intensity as the others but each light was of a different color. Each day, the plants were given light (each its own color) for 12 hours and left in darkness for 12 hours. The height of each plant was measured in centimeters at the end of each week for 10 weeks.
- Is there a control? If not, what control would you suggest?