

Experimental Design

How to design a good lab and write a good lab report

Scientists use various methods to investigate questions and come up with reliable answers and solutions



- The scientific methods used depend on the research being done.

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



A hypothesis is 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 4) experiment.

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

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

experimental group – does receive the variable being tested.

Variables

- 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

Independent or Dependent?

- 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

Once the experiment is set up 5) 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.



Representing Quantitative Data

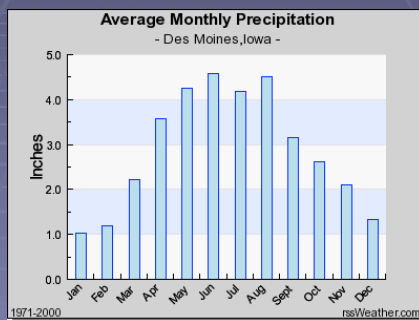
Independent Variable

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

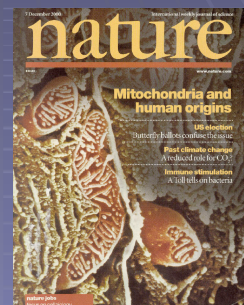
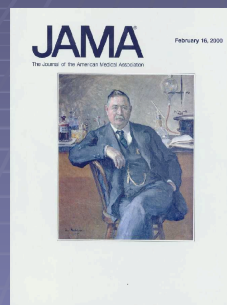
Dependent Variable

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

Once data has been gathered and organized it must be 6) analyzed (interpreted)



After analysis a researcher makes a 7) conclusion and 8) publishes (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.

Height (cm)	Week # →	1	2	3	4	5	6	7	8	9	10
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?)

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- Is there a control? If not, what control would you suggest?