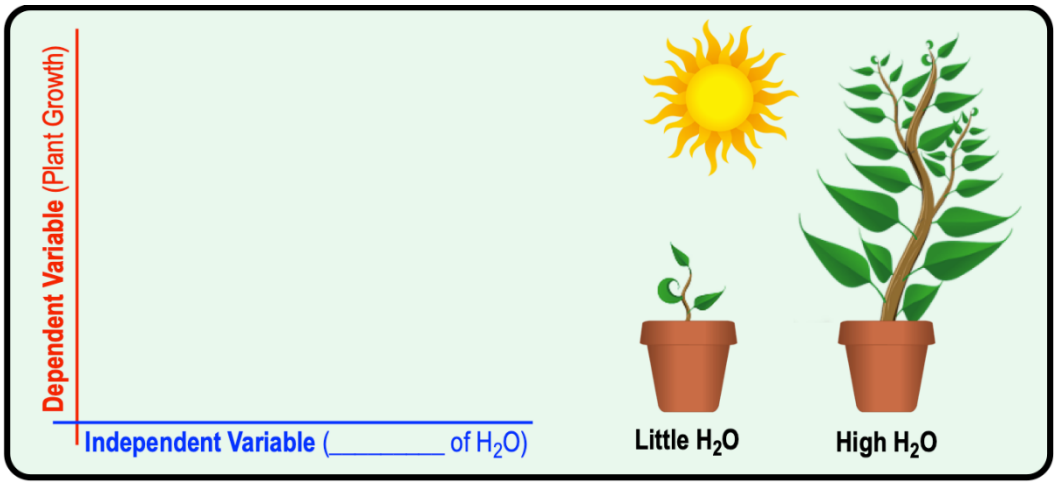
CONCEPT: EXPERIMENTAL DESIGN

Variables

- _____: a scientific investigation/procedure designed to test the validity of a hypothesis/theory.
- _____: a *changeable* element of the experiment.
  - □ Scientists investigate the relationship between _____ main types of *variables*:

EXAMPLE: Experiment Testing the Effect of Water on Plant Growth.

Variable Type	Definition	Example
1 _____ Variable	Variable _____ by the researcher.	Age, Time/Exposure, Amount, etc.
2 _____ Variable	Variable _____ by the researcher.	Growth of plant, Drug effectiveness, etc.



PRACTICE: Jonathan wants to know which style/model of paper airplane is going to win the contest by traveling the furthest. He designs 5 different models of paper airplanes and drops each of them from the same height of 20 meters. He records the distance that each plane travels before it hits the ground. What are the independent and dependent variables of Jonathan's experiment?

Independent Variable: _____

Dependent Variable: _____

PRACTICE: In an experiment to test the effect of temperature bacterial reproduction rate, temperature would be the:

a) Standardized variable. b) Dependent variable. c) Control variable. d) Independent variable.

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PRACTICE: The temperature at which an alligator's egg is incubated will determine the sex of the offspring. The dependent and the independent variables in this experiment are _____.

a) Sex of the baby alligator and temperature respectively.

b) Temperature and sex of the baby alligator respectively.

c) Size of the incubator and size of the baby alligator respectively.

d) Number of offspring and temperature in the incubator respectively.

False Positives/Negatives

●Well-designed experiments contain _____ *groups*, which help prevent *false positives/negatives*.

□ *False* _____: outcomes that *falsely* indicate the _____ of a result.

□ Example: Pregnancy test says you're pregnant when you're actually not.

□ *False* _____: outcomes that *falsely* indicate the _____ of a result.

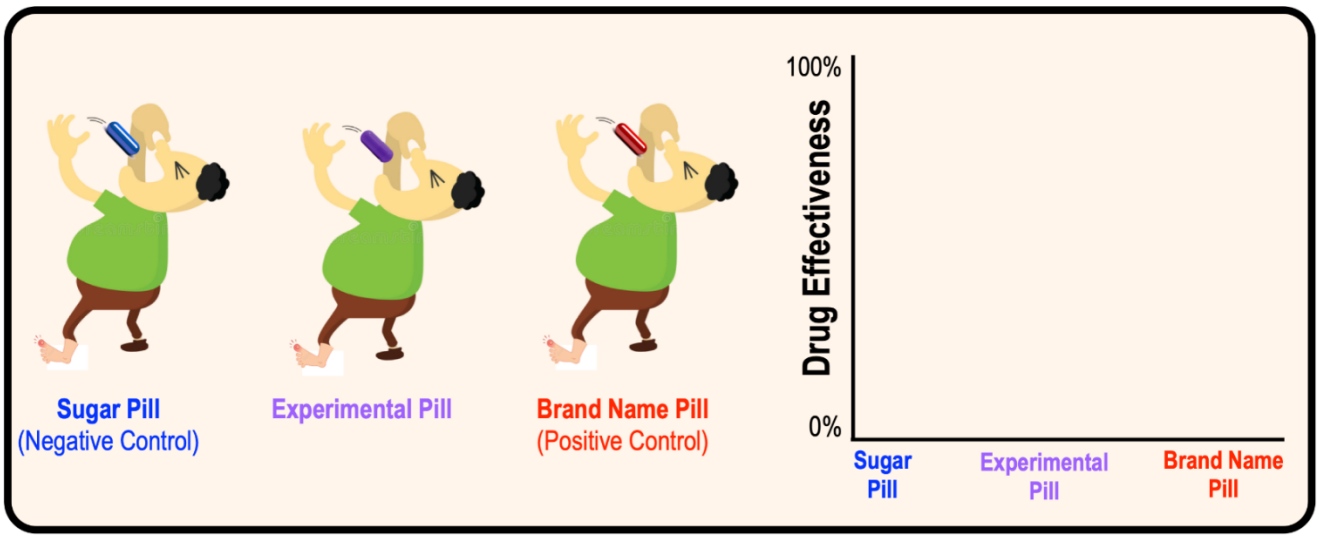
□ Example: Pregnancy test says you're NOT pregnant when you actually are.

Negative & Positive Controls

●_____ main types of controls used in experiments: 1) *Negative* Control & 2) *Positive* Control.

□ Ideally, the control groups only differ from the experimental group in the _____ factor being tested.

Control Type	Definition	Purpose
1 _____ Control	Control group where _____ *response* is expected (ex. placebo).	Prevents false *positives.*
2 _____ Control	Control group where a response is expected.	Prevents false *negatives.*



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EXAMPLE: A scientific researcher designs an experiment to test the effectiveness of a new sleeping pill compared to the brand name product. Match each of the following controls/outcomes in the experiment to their appropriate description:

a) Negative Control _____.
b) Positive Control _____.
c) False Positive _____.
d) False Negative _____.

1. A sugar pill that should have no effect on the patient.
2. Patient does not fall asleep after taking the brand name pill.
3. A brand name pill that has proven to work on patients.
4. A patient falls asleep after taking the non-effective sugar pill.

PRACTICE: A scientist wants to study the effects of nitrogen on wheat plants. They set up an experiment with 4 groups of plants: group A gets 20 pounds of nitrogen per acre, group B gets 40 pounds per acre, group C gets 60 pounds per acre, and group D gets 0 pounds per acre. Which of the following is the control group? Is it a positive or negative control group?

a) Group A. b) Group B. c) Group C. d) Group D.