Welcome to Greenhouse Biology!

Do Now:

1. Find your name at a table or lab bench and have a seat.
2. Quietly complete the “Student Profile” (materials are at your table).

GET TO KNOW YOUR CLASSMATES

Introduce yourselves to each other by telling your name and ONE of your favorite things

Be prepared to share what you wrote about science on the back of your card

LET'S REVIEW THE RULES AND EXPECTATIONS

WHAT TO EXPECT IN CLASS

- This class is designed to be **interactive**. Please be an active participant!
  - I encourage you to ask questions and challenge each other, but always be respectful to me and your classmates (Rule #1)

WHAT TO EXPECT IN CLASS

- Every day you can expect:
  - A “Do Now” activity - come in quietly and get started
  - A HW Progress Check (In person or in Canvas)
  - Short lectures and active participation
  - An exit ticket assignment (In person or in Canvas)

WHAT TO EXPECT OUTSIDE OF CLASS

- Homework - plan on spending no more than 30 minutes on your homework.*
  - Format: Video Lectures (YouTube) and Questions
  - A short reading/writing assignment

Study Time is separate from HW. You should spend extra time preparing for quizzes and exams.

WHAT YOU SHOULD EXPECT FROM ME

Every day, I will

- Challenge you.
- Respect you.
- Evaluate you fairly.
- Support you.

What else do you expect from me?

Let's play a game

- You will need one partner.
- Select one person to be the Observer and one person to be the SUBJECT.

Triples Game Wrap-up

- How many trials was needed to reach the “ultimate truth”?
- What does this game tell us about the nature of science?

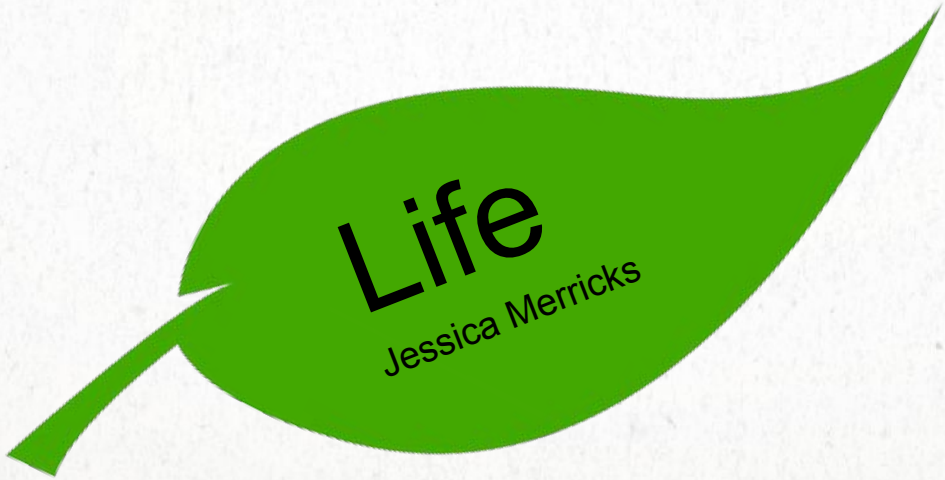
Wrap-up Conversations

What is Biology? What kinds of things do we think we will study?

Need ideas? Flip through the textbook (back of the classroom). Find something that interests **you**!

Exit Ticket

Use a marker to write the ONE word that relates to Biology on a leaf on one of the doors. Please write your name on the leaf as well.



8/29/2017

THE SCIENTIFIC METHOD

Do Now: (10 minutes)

Today we will talk about the Scientific Method. Right now, write down your ideas about the questions below. There are no wrong answers, but you must write down an idea for each question.

1. What is the Scientific Method?
2. What is the purpose of the Scientific Method?
3. How is the Scientific Method done?

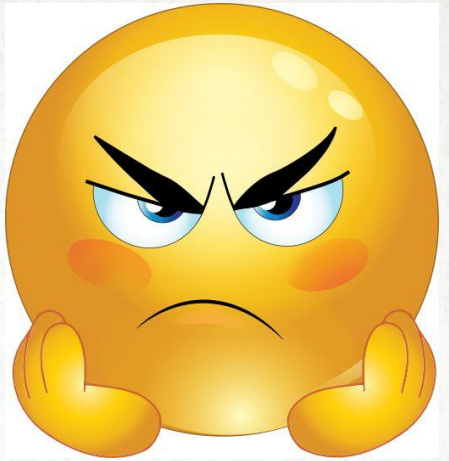
Do Now: Discussion

Let's go around the room and discuss our ideas. Be ready to share your idea about at least one of the questions.

1. What is the Scientific Method?
2. What is the purpose of the Scientific Method?
3. How is the Scientific Method done?

1. State the problem/observation

?!?!?



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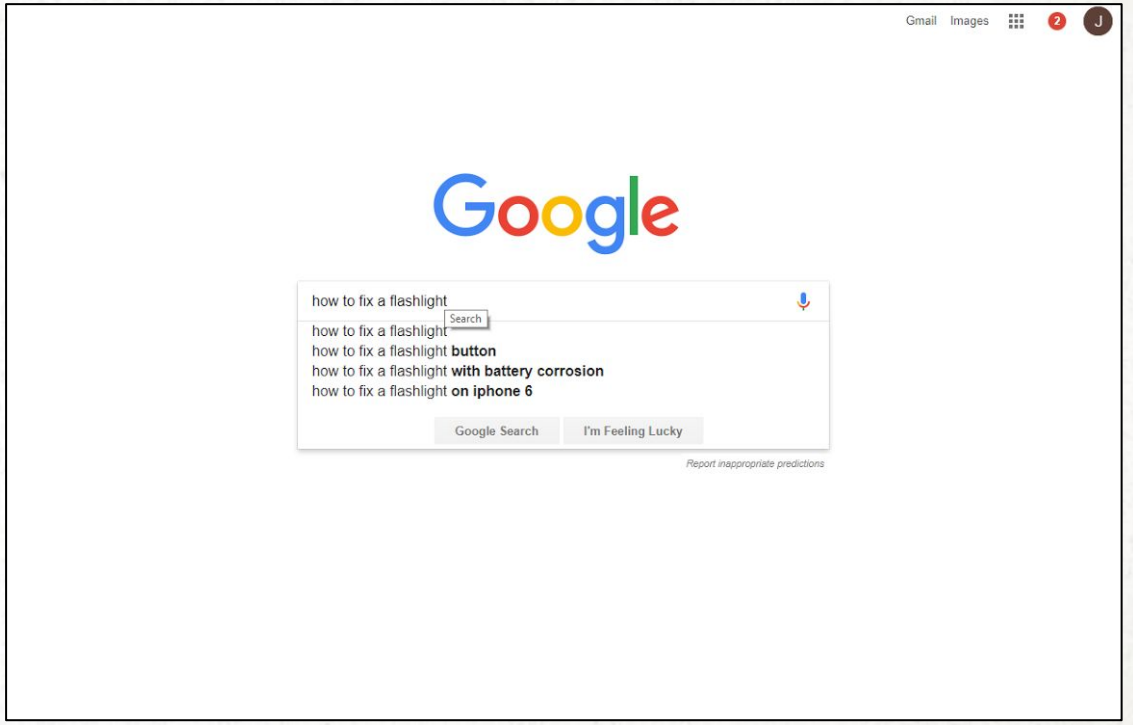
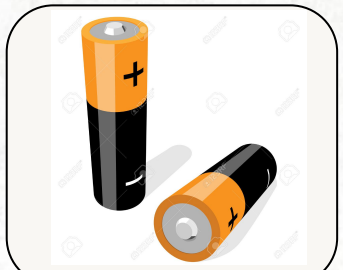
2. Collect information about the problem



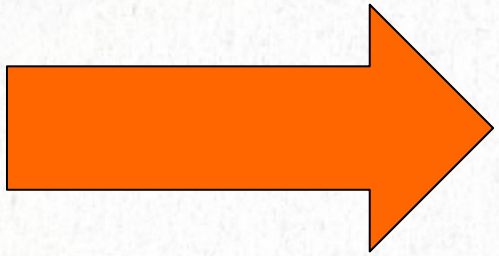
3. Form a HYPOTHESIS

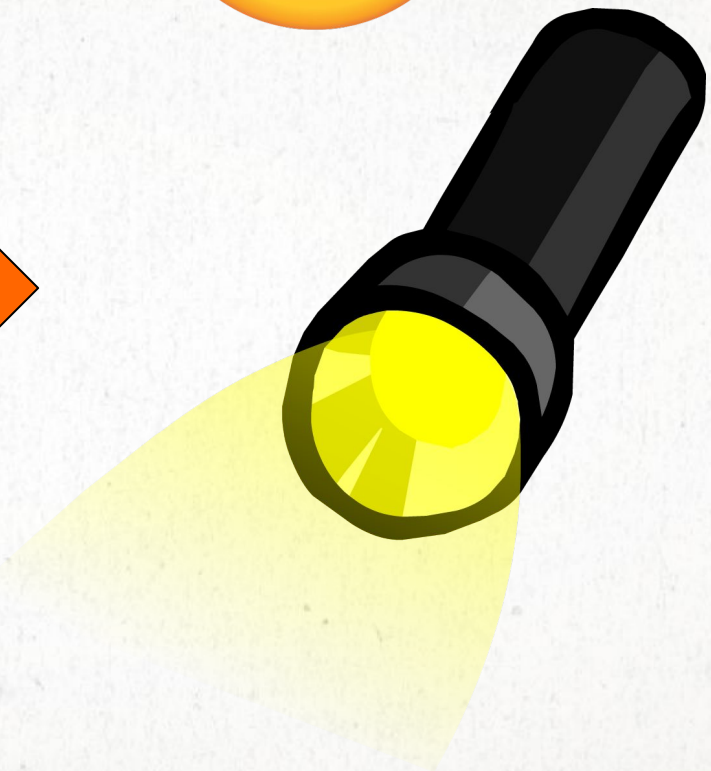
"If I put new **batteries** in the flashlight, the light will come on."



The hypothesis is an explanation that can be <u>tested.</u>

4. Test the hypothesis





5. Draw conclusion

6. Report Results

Journal of Flashlight Engineering

Troubleshooting a non-functioning flashlight
Eva Washington
Hawthorne Academy

Introduction

bafajdf ljfldfjks lasdk fjldskfjldsk fjlskd fjlasdkjflsjfldsfjls df flsadkjflfjld fjldsfjfds j

Methods

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Results

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Discussion

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Volume 5(1), 54-57.

Let's use science to put a claim to the test

Listen carefully to the commercial. Then discuss/write down the following in your group:

1. What does the commercial **claim**?
2. What is the **subject** of this commercial? According to the claim, what effect does the subject of the commercial have?

Let's design an experiment to test the claim made in the commercial.

The subject (the thing you will manipulate or modify):

The effect (the thing that you expect to change during the experiment:

In an experiment we call these the **Independent** and **Dependent** variables.

Let's design an experiment to test the claim made in the commercial.

What else do we need to think about to make sure our experiment is accurate?

We must keep everything else **constant** in our experiment. Why?

Let's design an experiment to test the claim made in the commercial.

In your group (4 students), design an experiment to test the claim made in the Lysol commercial. Write down the following:

- Hypothesis
- Independent Variable/Dependent Variable
- Method/Procedure of Experiment

Be prepared to share with the class in 15 minutes!

Homework for Wednesday:

1. Sign up for Remind (Text **@drmerric** to **81010**)
2. Watch the first Video Lecture: access through the class weebly page (merricksjscience.weebly.com)
    - Write down your answers to the questions throughout the video.

Homework for Thursday:

3. Get Parent Letter sheet signed (if you haven't already)

Exit Ticket

Think of a product that you use in your everyday life. How could you test the product to find out if it does what it claims to do?

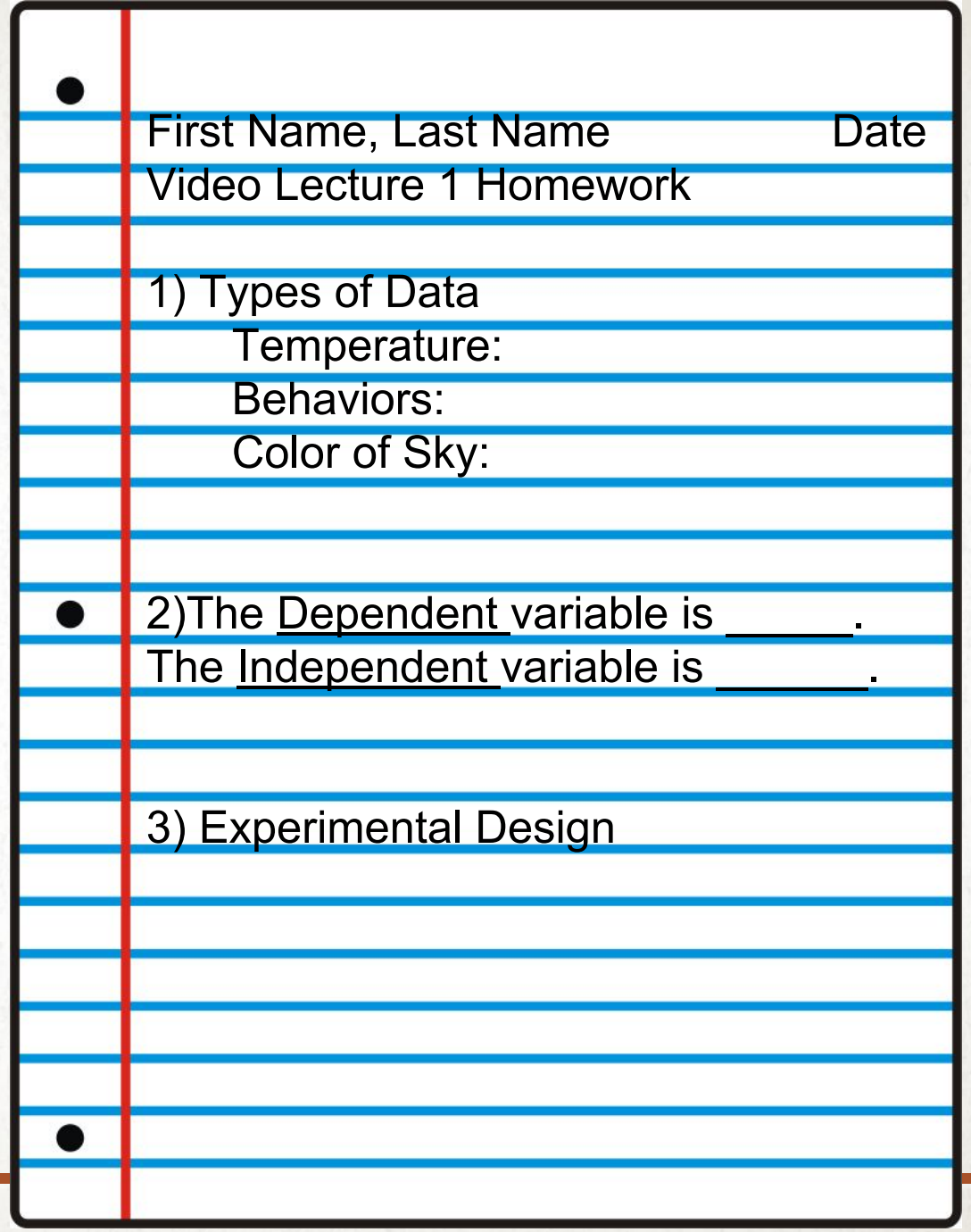
Each student will write down:

1. The name of the product
2. The purpose of the product
3. The steps he/she would take to test if the product does what it claims

THE SCIENTIFIC METHOD

Setting up for today's HOMEWORK

Pause the video here and get your paper set up and ready to go.



Essential Question:

How can science help us understand the world around us?

THE SCIENTIFIC PROCESS

- The word **science** is derived from Latin and means to “know”
- **Inquiry** is the search for information and explanations of natural phenomena
- The scientific process includes:
  1. Making observations
  2. Forming logical hypotheses
  3. Testing the hypotheses

1. MAKING OBSERVATIONS

- Biologists describe natural structures and processes
- Recorded observations are called **data**
  - **Qualitative** data are typically recorded descriptions
    - Example: Jane Goodall describes the behavior of chimps as "social, curious, etc."
  - **Quantitative** data are generally expressed as numerical measurements
    - Example: Claudia Kasper characterizes primate social networks by quantifying their distribution pattern and group structure

QUALITATIVE DATA

QUANTITATIVE DATA

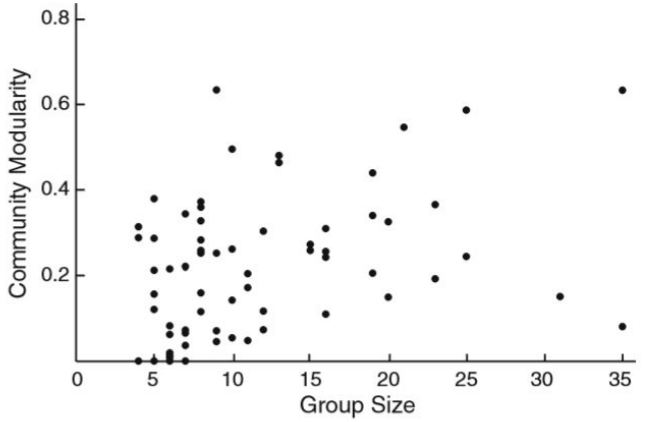


Fig. 5 Community modularity for all groups ($N = 70$) plotted against group size

Kasper and Bernhard, *Primates* (2009)

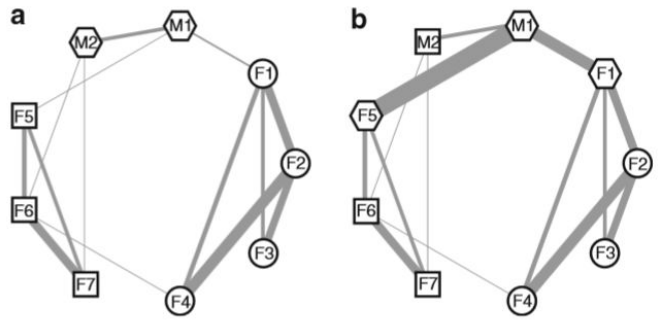


Fig. 6 A hypothetical example of a macaque group with two matrilines (F1–F4 and F5–F7) and two males (M1 and M2). In **a**, the *Q*-maximizing algorithm would group F1–F4 into subgroup 1 (*circles*), F5–F7 into subgroup 2 (*squares*), and M1 and M2 into subgroup 3 (*hexagons*). In **b**, we assume that M1 intensifies grooming with the two alpha-females of the matrilines, as might happen when these females are in estrus, while the other grooming relations remain unchanged. In this case the algorithm would group F2-F4 into subgroup 1, M2, F6, and F7 into subgroup 2, and M1, F1, and F5 into subgroup 3

Your first **HOMEWORK** item is below.

Identify the type of data as either **quantitative** or **qualitative**.

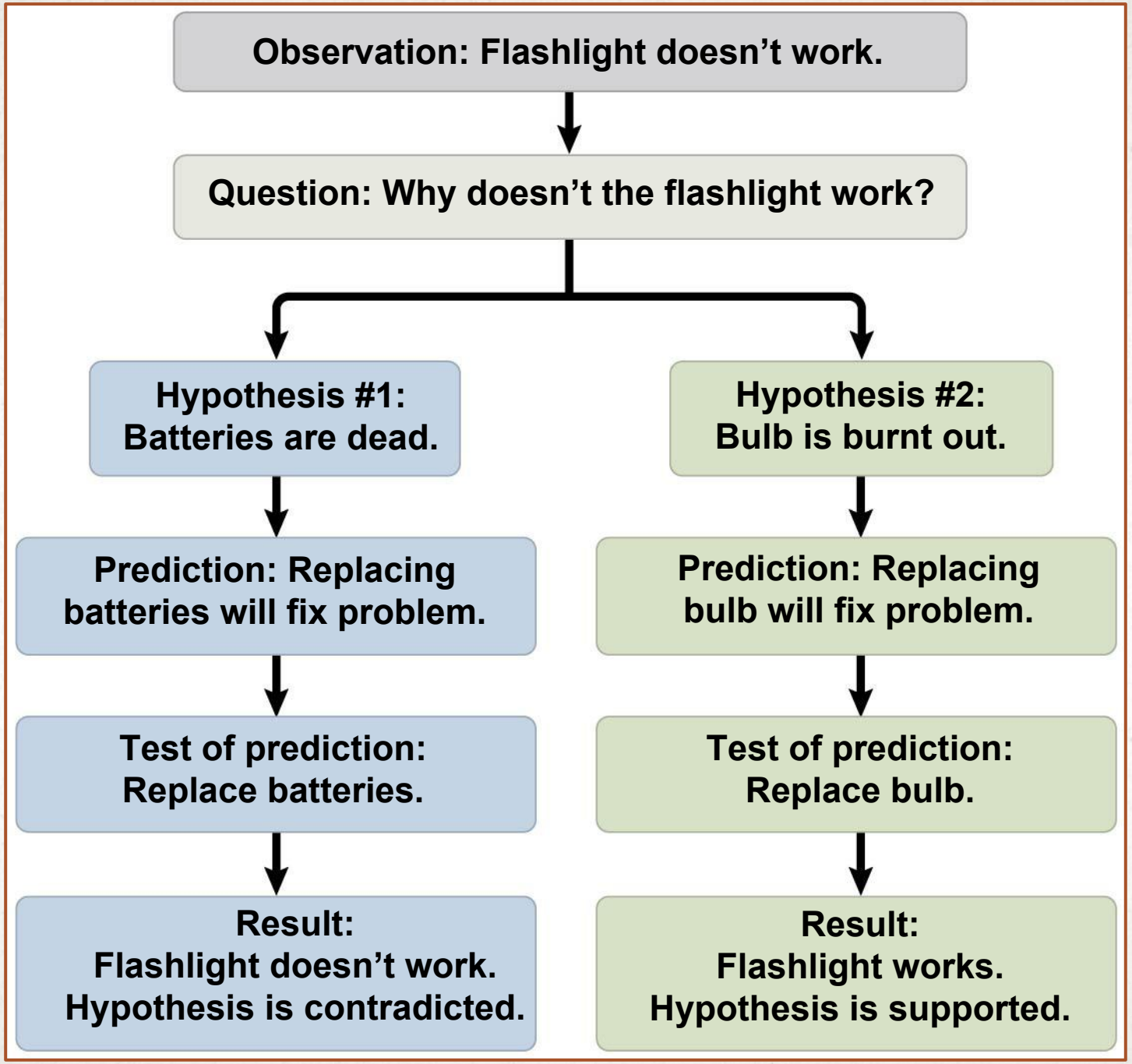
A. A scientist records temperature every day as part of a study of weather patterns. For example, “85℃, 89.5℃, 92.1℃”
B. A researcher studies the types of interactions between a group of young kittens. For example “aggressive, playful, etc.)
C. A scientist observes the changes in the color of the sky throughout the day with his naked eye. For example, “light blue, pink.”

2. FORMING HYPOTHESES

- In science a **hypothesis** is a tentative answer to a well-framed scientific question
  - Based on a set of observations
  - Must be testable, and falsifiable

3. TESTING HYPOTHESES

- Hypotheses lead to **predictions** that can be tested by making additional observations or by performing experiments


Observation: Flashlight doesn't work.
Question: Why doesn't the flashlight work?
Hypothesis #1: Batteries are dead.
Hypothesis #2: Bulb is burnt out.
Prediction: Replacing batteries will fix problem.
Prediction: Replacing bulb will fix problem.
Test of prediction: Replace batteries.
Test of prediction: Replace bulb.
Result: Flashlight doesn't work. Hypothesis is contradicted.
Result: Flashlight works. Hypothesis is supported.

EXPERIMENTAL VARIABLES AND CONTROLS

- In a **controlled experiment**, an experimental group is compared with a control group
- Ideally these groups differ in only the one factor under investigation
- Why do we need to conduct **controlled experiments**?

EXPERIMENTAL VARIABLES AND CONTROLS

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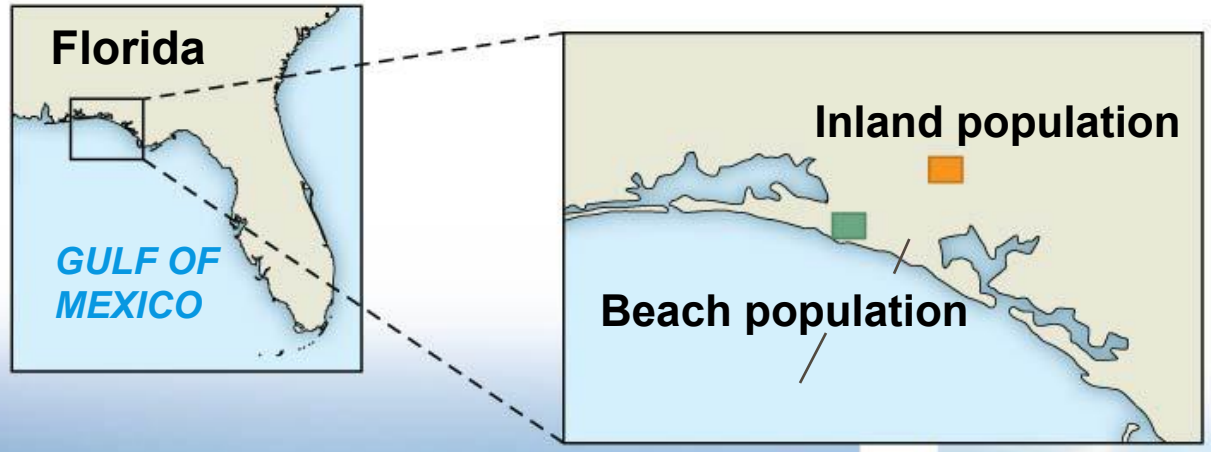
Example: Investigating coat coloration in mouse populations

- Two populations of a mouse species have different color patterns and live in two different environments.
- The beach mouse lives on white sand dunes with sparse vegetation; the inland mouse lives on darker soil



Beach population

Inland population

1. MAKING OBSERVATIONS

- The two types of mice match the coloration of their habitats
- Natural predators of these mice are all visual hunters

2. FORMING HYPOTHESES

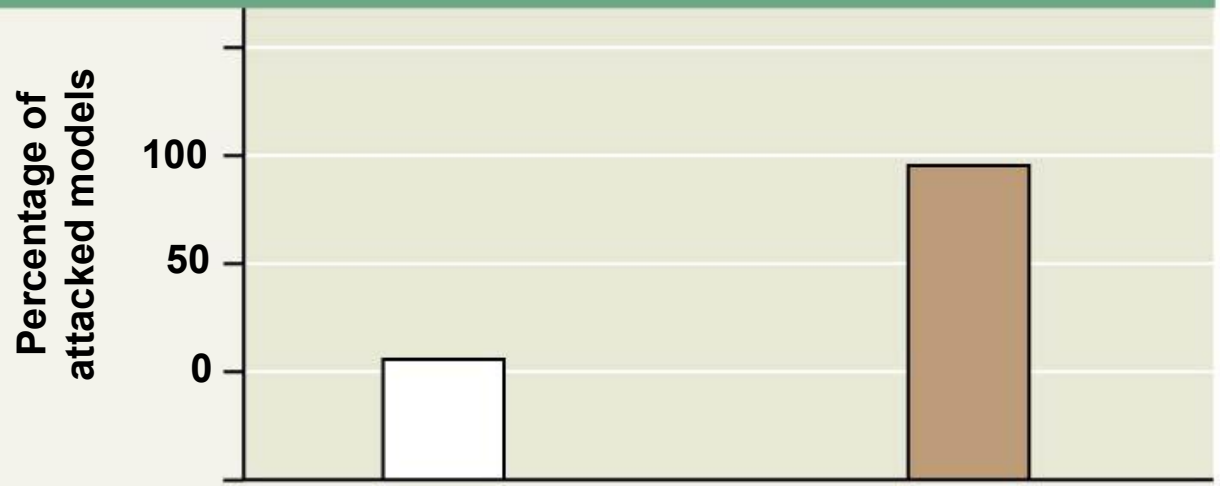
- Researchers **hypothesized** that the color patterns had evolved as adaptations to protect the mice from predators

3. TESTING HYPOTHESES

- **Prediction**: mice that do not match their habitat would be preyed on more heavily than mice that did match the surroundings
- **Experiment**: They built models of mice, painted them to match one of the surroundings, and placed equal numbers of each type of model in each habitat
- They then recorded signs of predation

Results

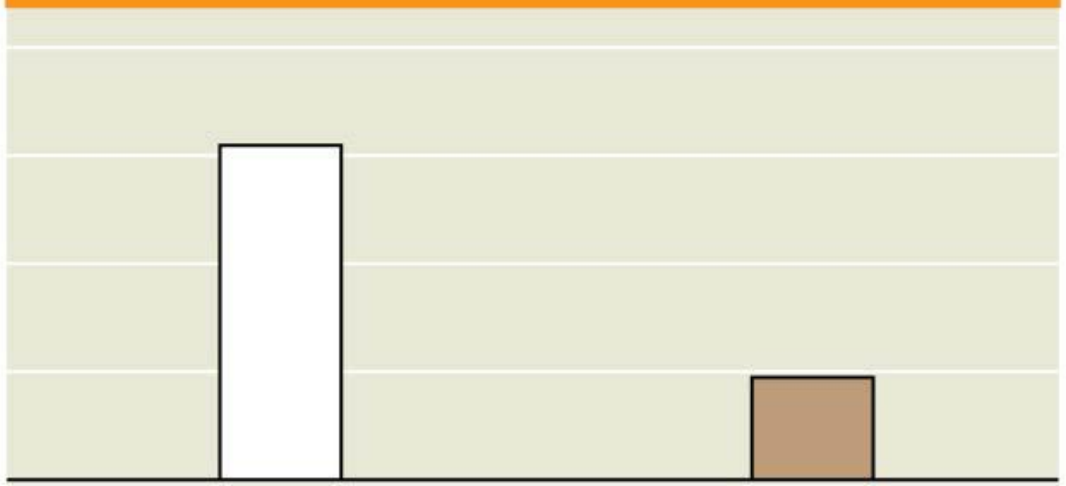
Beach habitat

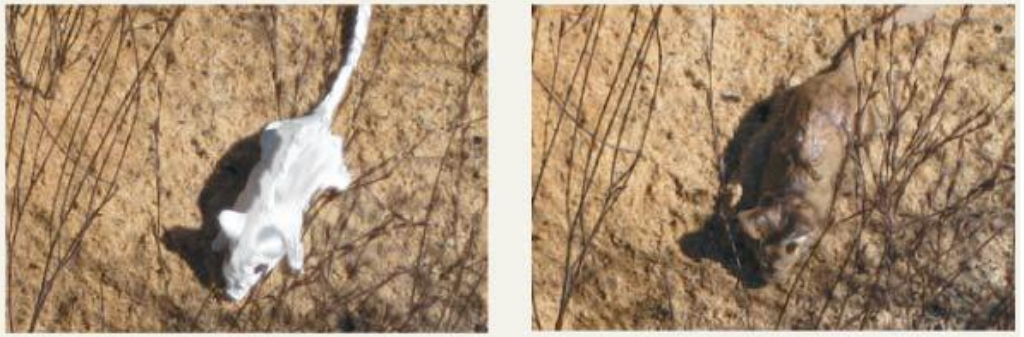


Camouflaged (control)

Non-camouflaged (experimental)

Inland habitat





Non-camouflaged (experimental)

Camouflaged (control)

Practice with the parts of an experiment

For your second **HOMEWORK** item, identify the **Independent Variable** and **Dependent Variable** of the experiment described described in the previous slide.

Essential Question:

How can science help us understand the world around us?

So, what can't science do?

Limitations of Science

Science is OBJECTIVE, not SUBJECTIVE

- All scientific hypotheses must be testable and falsifiable
- Science can NOT address moral, aesthetic, or philosophical questions

  Example: Is it right to genetically modify an animal for human consumption?)

- Science can NOT assume or deny the supernatural

  Example: “Did God create the Universe?”

Take away points about the Process of Science

- The scientific method is an *idealized* process of inquiry
- Science is all about backtracking and “rethinking”
  - We are constantly trying to get to the ultimate truth, but in reality, science never proves anything.

CONCLUSIONS

You have now reviewed the basics of the scientific method and how to design a simple experiment. Now, ask yourself:

- What are the steps of the scientific method?
- What are the two types of data?
- What are the components of an experiment?

If you are unsure about anything covered in this video, write it down and bring it with you to class.

CONCLUSIONS

Your final **HOMEWORK** item is this:

How would you design an experiment to test the claim that the amount of time a person spends studying is related to the score they earn on a test? In your answer, include the IV, DV, and control variable.

THE SCIENTIFIC METHOD

August 31, 2017

Do Now

1. Take out your homework

2. Complete the handout at your seat. Find the **Independent Variable** and the **Dependent variable** in each statement.

Writing a good hypothesis

- What do we already know about a hypothesis (refer to your Video Lecture or notes from earlier this week)?

Writing a good hypothesis: the "If… then…because" statement

- The hypothesis tells the reader what you believe will happen in your investigation
  - **IF**…tells the readers what will be changed. This is the Independent Variable
  - **THEN**… tells the reader what will happen because of the change (Dependent Variable)
  - **BECAUSE**… tells the reader how you know this will occur.

Examples

- **If** 7 th graders and 8th graders complete the same math problems, **then** the 8 th graders will have more answers correct, **because** they have studied math for one year longer than the 7th graders.

- **If** dry bread and moist bread are left in bags for two weeks, **then** the moist bread will grow mold more quickly than the dry bread, **because** mold is a living organism, and organisms need water to survive.

Let's Practice

1. Melissa raises crickets at her pet store that she sells for reptile food. She thinks that crickets chirp more often when the temperature gets warmer. She decides to conduct an experiment to prove her theory.

Hypothesis: If _____(IV) then _____ (DV), because_____ _____.

Let's Practice

2. The cooler the temperature in a lake, the more oxygen the water holds. Daniel notices that he catches more fish in a lake that is cooler than 55 degrees. He wants to conduct a study so he can catch the most fish possible this year. He's having trouble writing a hypothesis. Please help him.

Hypothesis: If _____(IV) then _____ (DV), because_____ ____.

Collecting Data

What do we know about the types of data that scientists collect?

Qualitative VS Quantitative Data

Example 1:

Oil Painting

Qualitative data:

- blue/green color, gold frame
- smells old and musty
- texture shows brush strokes of oil paint
- peaceful scene of the country
- masterful brush strokes

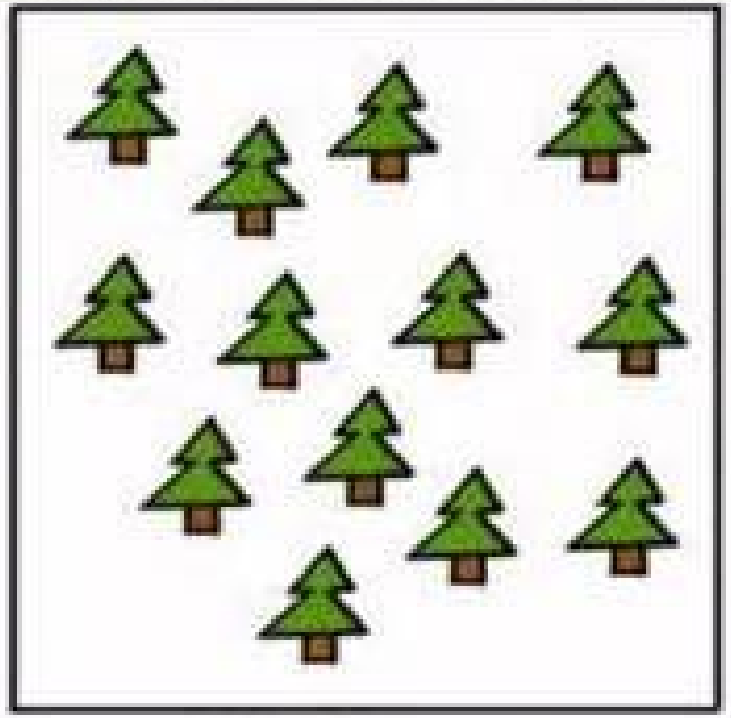
Example 1:

Oil Painting

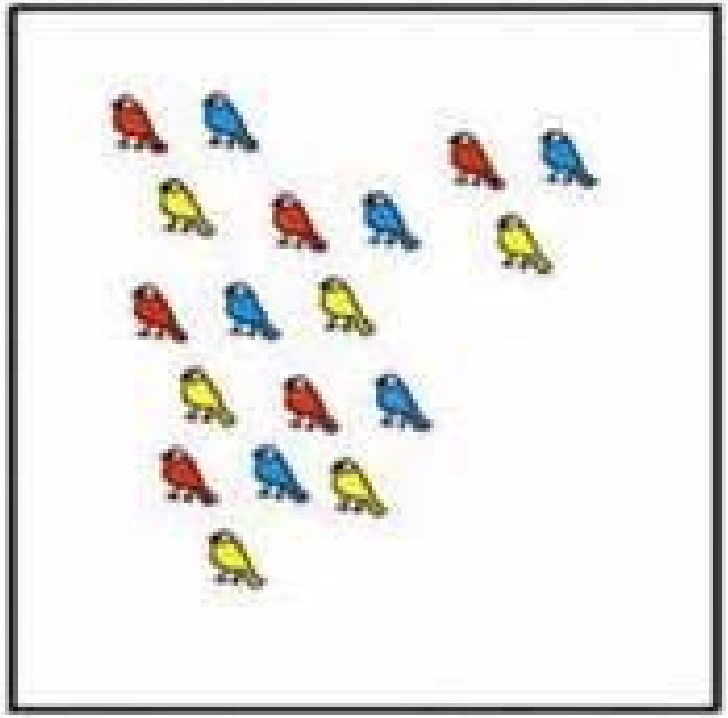
Quantitative data:

- picture is 10" by 14"
- with frame 14" by 18"
- weighs 8.5 pounds
- surface area of painting is 140 sq. in.
- cost $300

Qualitative VS Quantitative Data



13 Trees



Blue, Red, and Yellow Birds

Qualitative VS Quantitative Data - Group Practice

You will now be given an object. You and your team must record 3 pieces of quantitative data and 3 pieces of qualitative data.

You my use any of the tools at the front of the room to collect your data.

Quiz #1: Tuesday, September 5

Our first quiz will be in class on Tuesday. It will cover all of the material from Monday - Friday of this week (Scientific Method)

The quiz will be multiple choice and fill in the blank. There will be one short answer question that will involve you writing a hypothesis and designing a simple experiment.

To prepare, review the lecture notes and in class activities from this week.

Exit Ticket

Write down one new thing that you learned today.

Write down one question you have for Dr. Merricks about our first quiz.

The Scientific Method

September 1, 2017

Do Now - Get ready with paper and pencil (2 minute warning)

Write a complete hypothesis for the three following scenarios. You will have three minutes per scenario. Remember to use proper format (see below). This assignment is worth **10 points**.

"If _____(IV) then _____ (DV), because_____."

Do Now (Item 1) - 5 minutes

Kasey lives in Moab, Utah. She likes to mountain bike for miles and miles until she can't bike anymore. She thinks that she can bike further when she drinks more than a liter of water before her bike ride. Please assist her in developing a hypothesis, so she can make the best of her future bike rides.

Do Now (Item 2) - 3 minutes

Mr. Montanari has noticed that there is a wide range of grades that students get on tests, even though they are all in the same class. He wonders whether students, who study for 20 minutes per night, every night, get higher scores on tests or not. Please help him write a hypothesis.

Do Now (Item 3) - 3 minutes

Jimmy notices that he tends to get lower grades when he does his science lab work with his friend Joe. Jimmy and Joe like to talk about basketball during science. Jimmy has decided to investigate if his science lab grades are higher when he works with Joe or if they're higher when he works with someone else. Help him write a hypothesis for his study.

Quiz #1: Tuesday, September 5

Our first quiz will be in class on Tuesday. It will cover all of the material from Monday - Friday of this week (Scientific Method)

The quiz will be multiple choice and fill in the blank. There will be one short answer question that will involve you writing a hypothesis and designing a simple experiment.

To prepare, review the lecture notes and in class activities from this week.

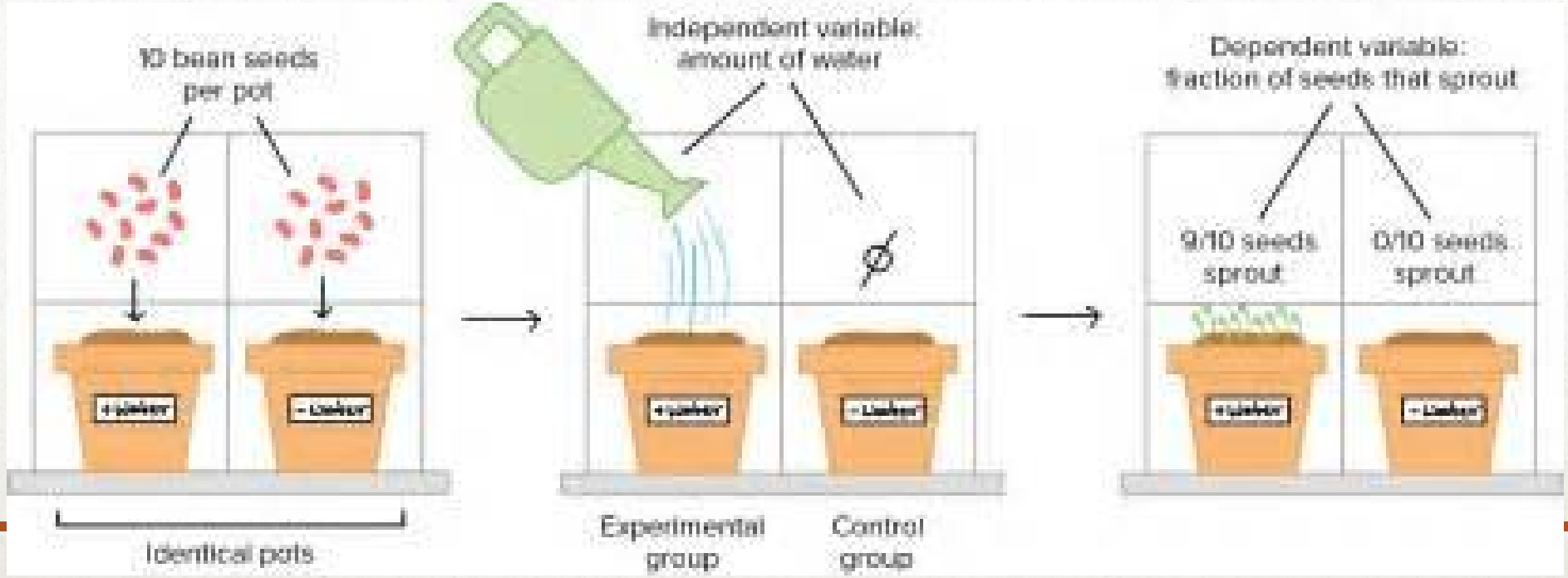
Final notes about the Scientific Method

Most experiments involve at least two study groups:

- **Experimental Group:** a group of subject that will experience the effect of the Independent Variable
- **Control Group:** a group that will not experience the effect of the Independent Variable (this group is used for comparison)

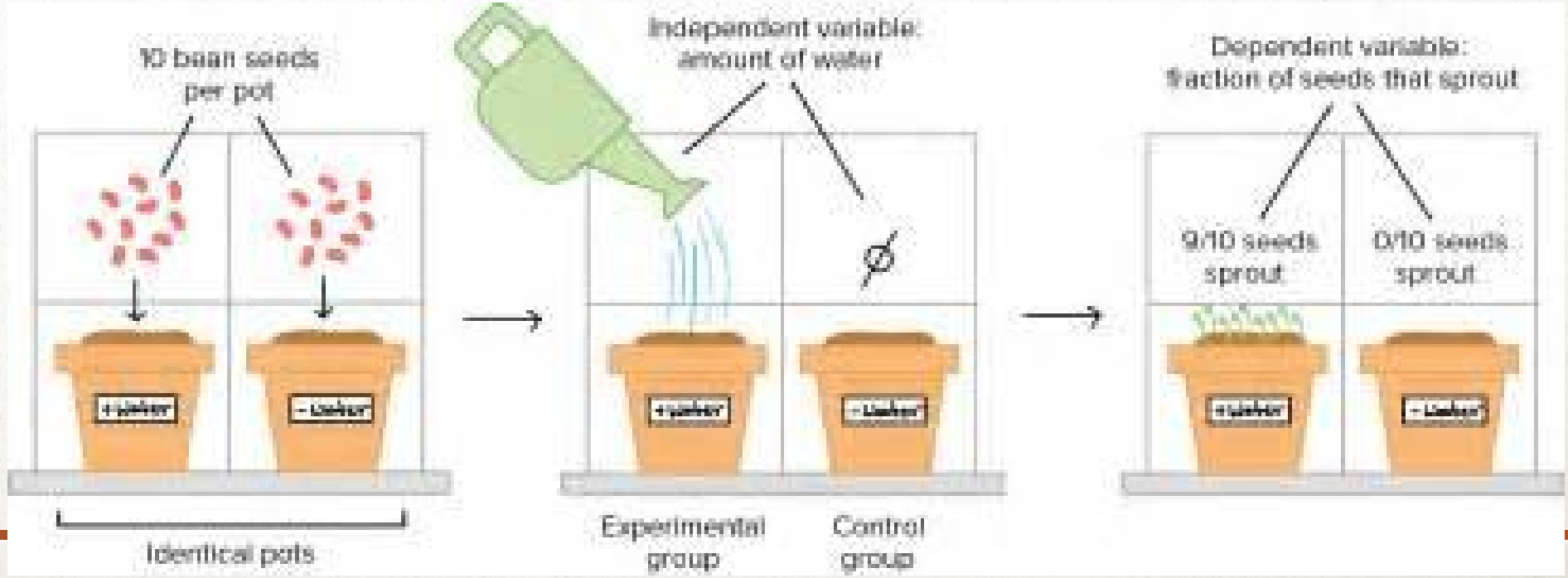
Final notes about the Scientific Method

For example: If you are interested in studying the effect that water has on plant growth, you could design an experiment like this:



Final notes about the Scientific Method

Control variables are factors that must be kept constant across the experimental and control groups. What variables should we control in this experiment?



Let's do an experiment

You will be assigned to a lab team for this assignment.

- Each team needs two data collectors and two data recorders
- Record notes/data in your notebook first, and then copy over your final answers on your lab report.
- The lab report should be completed collaboratively. Each student should write the answer at least one of the steps. This is your last assignment for this unit. **It is worth 20 points.**

Exit Ticket

Write down one thing you **know** about the scientific method.

Write down one **question** you have about the scientific method.