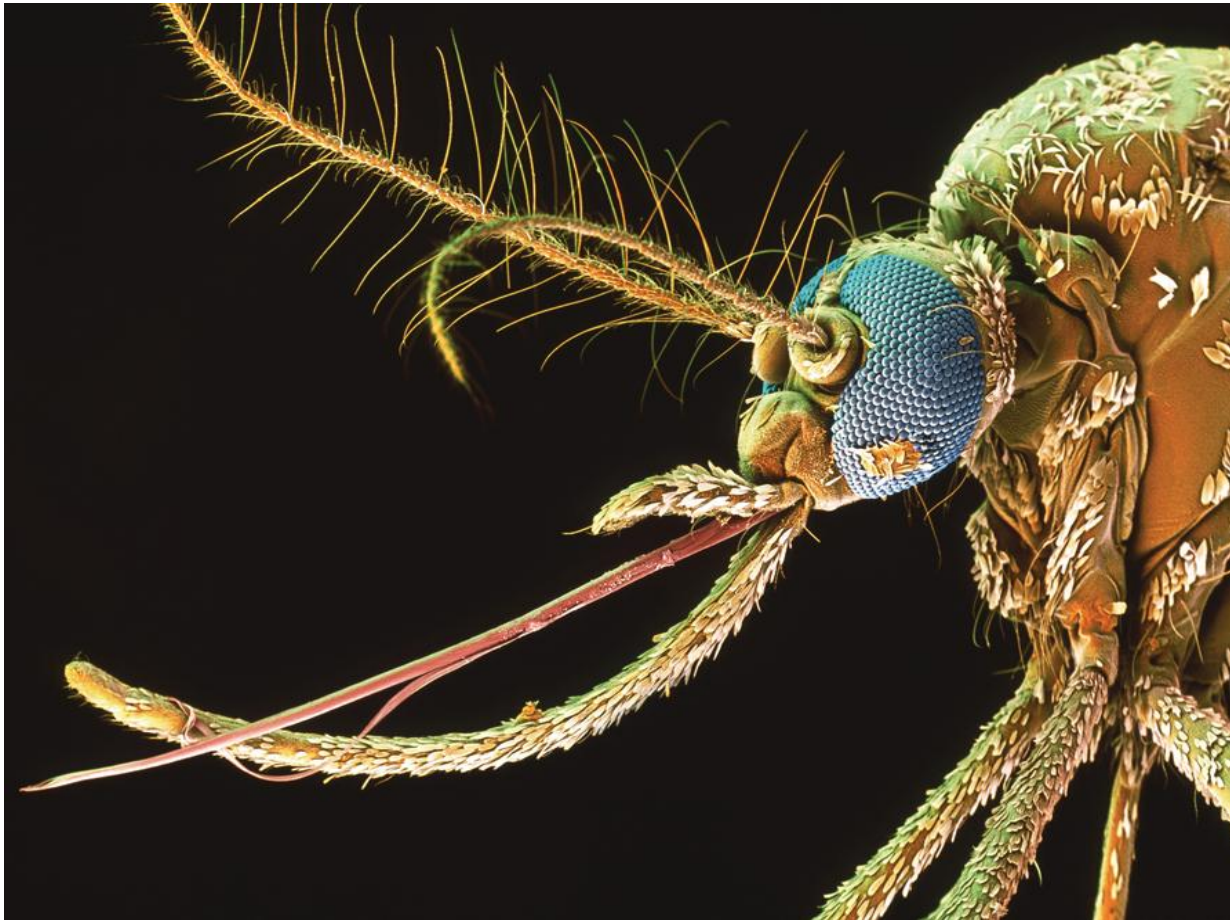




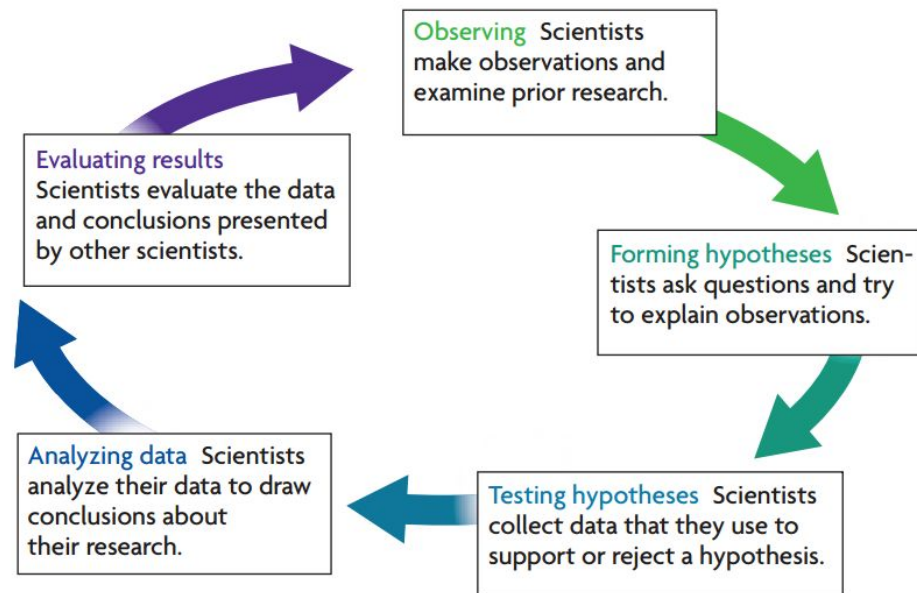
THE SCIENCE OF BIOLOGY

Science is a way of thinking, questioning, and gathering evidence



Like all science, biology is a process of inquiry.

- Scientists make careful and systematic observations.
- Scientists record observations as data.
- Scientists form a hypothesis as a possible answer to a question.
- Scientists test their hypotheses and analyze their data.



Experimental studies allow scientists to determine what causes a phenomenon.



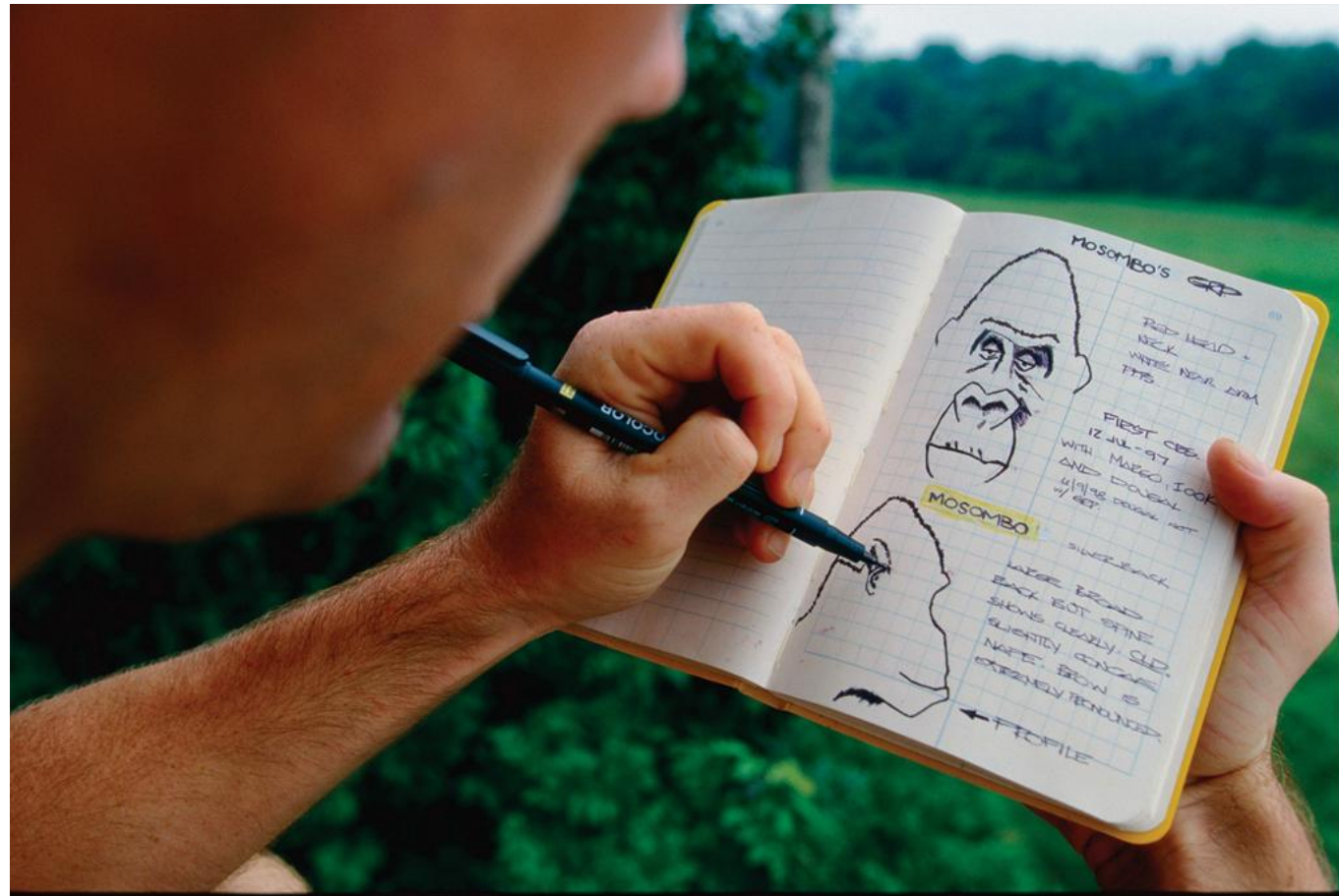


The Goal of Science

- 1) deals only with the natural world
- 2) to collect and organize information
- 3) propose explanations that can be tested
- **Science** - using evidence to learn about the natural world; a body of knowledge
- Science begins with **observations**
- **data** - the information gathered from observations
 - quantitative data** = numbers
 - qualitative data** = descriptive
- **inference** - a logical interpretation based on prior knowledge or experience
- **hypothesis** - a proposed scientific explanation

Steps of the Scientific Method

1. Collecting observations
2. Asking questions





Steps of the Scientific Method

3. Making a hypothesis and predictions
 - a. hypothesis- An educated guess based on what is already known.
 - b. predictions- The expected outcome of a test assuming the hypothesis is correct.



Steps of the Scientific Method

4. Experimentation – an experiment is a planned procedure to test a hypothesis.
 - a. Control group- Does not receive special treatment (the variable) and is used as a comparison for the experimental group.



b. Experimental group- Receives the treatment (the variable) and otherwise identical to the control group

c. Constant: a variable that always stays the same
Anything in your experiment that is the same for all groups

A teal-colored abstract background with organic, flowing patterns, resembling coral or underwater plants, occupies the top portion of the slide.

d. Independent variable (x-axis)- The factor or variable that is changed in the experiment.

- Example: change vs. time

e. Dependent variable (y-axis) - The variable that is measured in the experiment.

- Example: change vs. time

VISUAL VOCAB

The **independent variable** is a condition that is manipulated, or changed, by a scientist.

independent variable



dependent variable

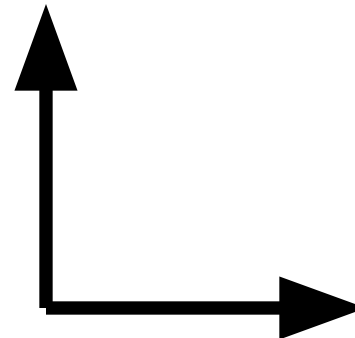
Dependent variables are observed and measured during an experiment; they are the experimental data.

****Memory Hint****

Look at your left hand. Squeeze fingers together and separate thumb. The thumb is “independent” of the fingers, so it goes on the x-axis. Fingers are “dependent” on each other so they go on the y-axis. This helps you remember where to put the dependent and independent variables.



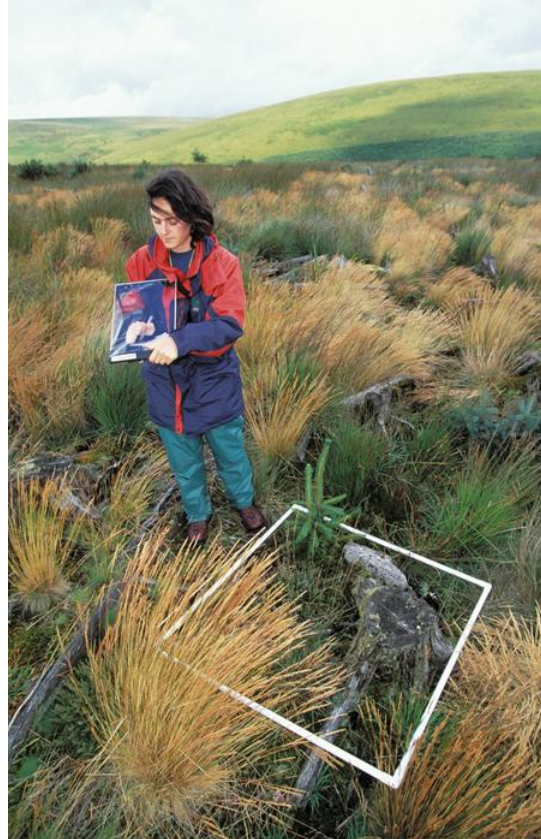
y – dependent



X - independent

Steps of the Scientific Method

5. Once the data is analyzed, a conclusion is made as to whether or not the data supports the hypothesis.



BUT FIRST, TAKE SCIENCE

#SELFIES

Start with an observation

Establish the question

Look into the topic

Formulate a hypothesis

Investigate the hypothesis

Examine the data

Share your results

Example of the scientific method

Redi's experiment:

- **Question/Observation**

- It was once believed that life could come from nonliving things, such as mice from corn, maggots from rotting meat, and fish from the mud of previously dry lakes. Francesco Redi wanted to disprove the theory that maggots could be spontaneously generated from meat.

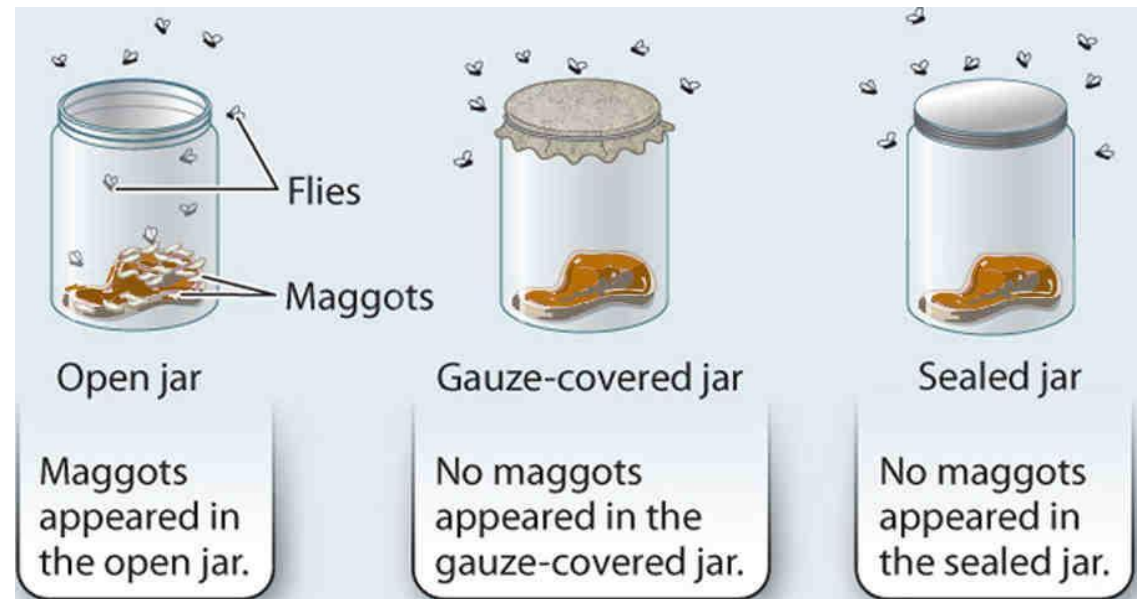
- **Hypothesis**

- **If the flies have contact with the meat, then maggots will grow.**

- **Experiment...**



- Redi's experiment:
- **Experiment**



- **Results?**

- **Conclusion:** Spontaneous generation of maggots from meat does NOT occur. Flies are the source of maggots.



- Redi's experiment:

- **Independent variable-**
things that I control

Open/ closed jar

- **Dependent variable-**
what did you measure?

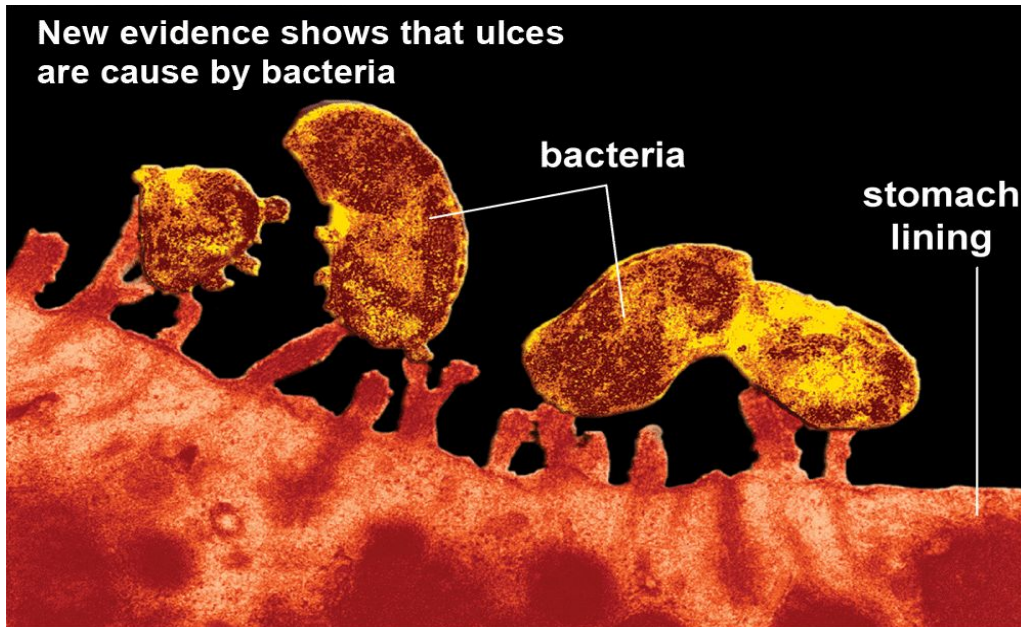
Number of maggots

- **Constants-**
things that stay the same

**Size of meat, size of jar,
time, temperature, place**



- Theory - A set of related hypotheses that have been tested and confirmed many times by many different scientists.
 - Examples: Theory of Gravity, Plate Tectonic Theory, Big Bang Theory, Theory of Evolution



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Theory

- When scientists use the word theory, it has a different meaning to normal everyday use.
- In everyday use, *theory* means a guess or a hunch, something that maybe needs proof.
- In science, a theory is not a guess, not a hunch. **A theory is a well-substantiated, well-supported, well-documented explanation for our observations.**



Law

- Some people think that in science, you have a theory, and once it's proven, it becomes a law. **That's not how it works.**
- In science, we collect facts, or observations, we use *laws* to describe them, and a *theory* to explain them.
- A *theory* never becomes a *law*. Laws describe things, theories explain them.



Theory/Law Example

- There's a *law* of gravity, which is the description of gravity. It basically says that if you let go of something it'll fall. It doesn't say why.
- Then there's the *theory* of gravity, which is an attempt to explain why. (Newton's Theory of Gravity and Einstein's Theory of Relativity).
- These explanations are called theories, and will always be theories. They can't be changed into laws, because laws are different things. **Laws describe, and theories explain.**

Science checklist:

How scientific is it?

- ☒ Focuses on the natural world
- ☐ Aims to explain the natural world
- ☐ Uses testable ideas
- ☐ Relies on evidence
- ☐ Involves the scientific community
- ☐ Leads to ongoing research
- ☐ Benefits from scientific behavior

- **biology** means the study of life / Bios = life -logy = study of





The 8 Characteristics of Living Things:

- 1) Cell - smallest unit of life
 - unicellular = single celled
 - multicellular = many celled
- 2) Reproduction
 - sexual reproduction - DNA from two different parents
 - asexual reproduction - single parent (cloning, budding)
- 3) Genetic Code - directions for inheritance (DNA)
- 4) Growth and Development
 - growth = getting larger
 - development = changing shape and structure
- Differentiation = cells that look different and perform different functions

- 5) Obtain and use energy
metabolism - chemical reactions
- plants - photosynthesis Animals - eating
- 6) Response to the Environment
stimulus - a signal to which we respond
response - a reaction to a stimulus
- Ex: school bell rings, we move to next class
- 7) Internal Balance
homeostasis - internal conditions
remain constant
- Ex: lizards sun themselves
- 8) Evolution - Change over time



