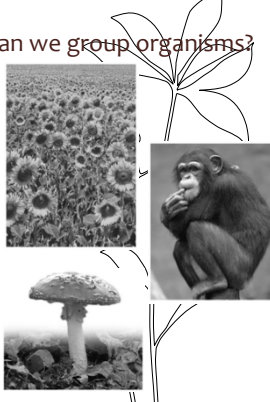


Opening Questions: How can we group organisms?

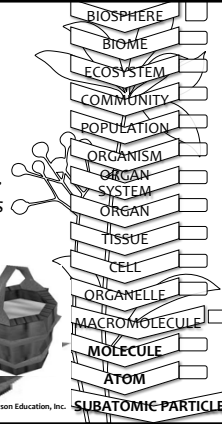
- What are the differences and similarities among the following groups of organisms?
- A sunflower (plant)
- A chimpanzee (animal)
- A mushroom (fungi)



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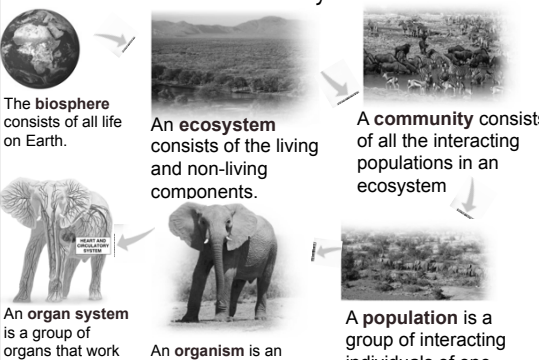
HIERARCHY

- "B bec pooot commas"
- Or...
- Betty Boop Eats Creamy Club Panini's Outdoor on our Terrace. Cartoons offer magical moments almost secretly.



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Life can be studied at many levels



The biosphere consists of all life on Earth.

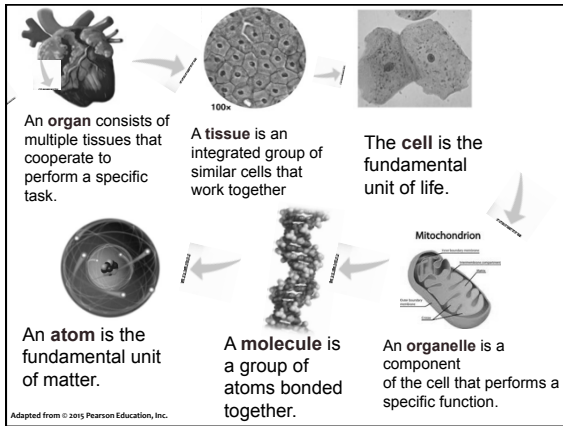
An ecosystem consists of the living and non-living components.

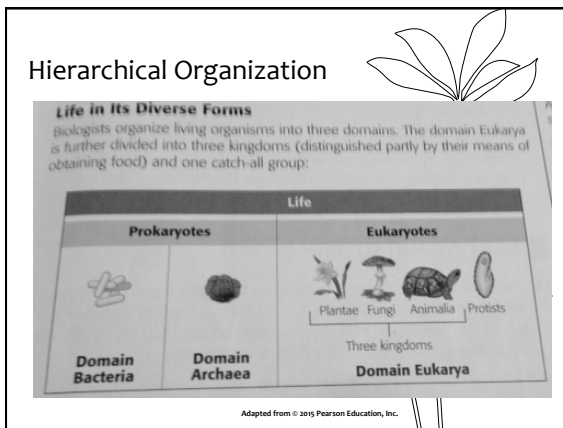
A community consists of all the interacting populations in an ecosystem.

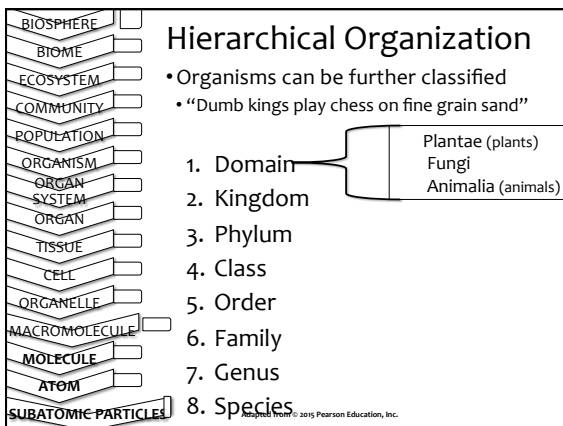
An organ system is a group of organs that work together.

An organism is an individual living being.




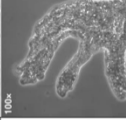
A population is a group of interacting individuals of one species.







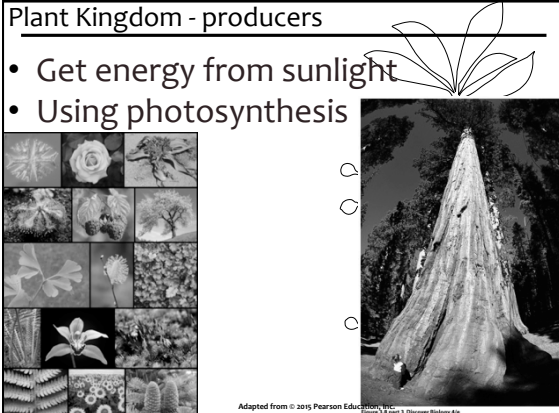
Kingdoms of domain Eukarya:

DOMAIN EUKARYA			
Kingdom Plantae	Kingdom Fungi	Kingdom Animalia	Protists
			
<ul style="list-style-type: none"> • multicellular • use sunlight to produce sugars via photosynthesis 	<ul style="list-style-type: none"> • single-celled or multicellular • decompose and digest dead organisms 	<ul style="list-style-type: none"> • multicellular • eat and digest other organisms 	<ul style="list-style-type: none"> • single-celled or multicellular • catch-all category for all remaining eukaryotes • includes many kingdoms

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Plant Kingdom - producers

- Get energy from sunlight
- Using photosynthesis



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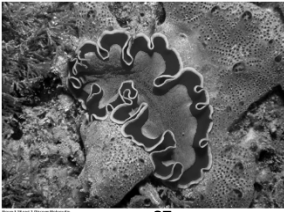


Fungi Kingdom - decomposers

- Get energy from decaying organisms



Animal Kingdom: Consumers

- Get energy from consuming other organisms



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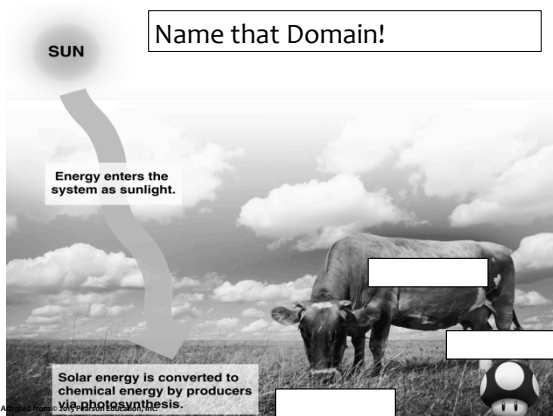
Protists – Many Kingdoms?

- Junk Drawer – Everything else



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Name that Domain!



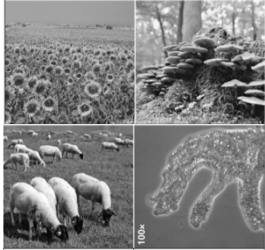
SUN

Energy enters the system as sunlight.

Solar energy is converted to chemical energy by producers via photosynthesis.

An organism that has fur, produces milk, and has live young belongs to which kingdom?

- a. Plantae
- b. Fungi
- c. Animalia**
- d. Protists

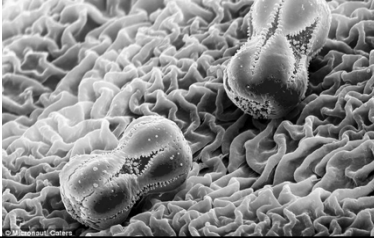


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Opening Questions: What are the limits?

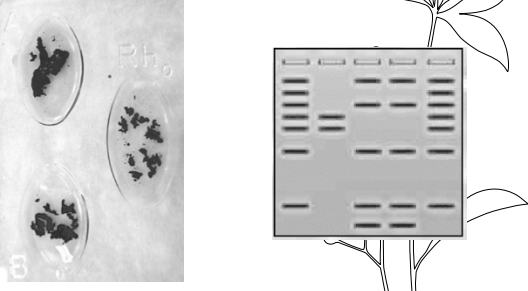
- Does the discipline of science have any limits?
- What might be an example of a limit?
- Are there any questions science can not answer?

Science – constantly expanding, but always limited.



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The changing limits of science: paternity testing



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What is science?

- Observation is the first step in science.
- The scientific method serves as a guideline for a scientist to understand an observation.

The scientific method depends on **hypotheses**.

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Try on your own:

- You go to the doctor with a sore throat. After examining you she says that she thinks it may be strep throat and takes a swab culture of your throat. She tells you she'll call in a prescription for antibiotics tomorrow if the results of the strep test are positive.
- Write out this scenario as the steps of the scientific method. Which step is the initial diagnosis?

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How can scientists narrow down the variables?

- **Controlled experiments** investigate a hypothesis by changing only one variable.

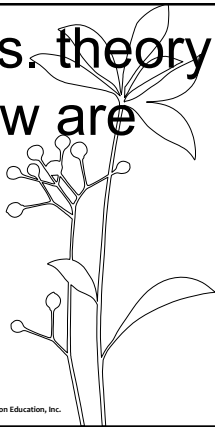
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Why are controls helpful?

- I have a cold and I decide to take large amounts of vitamin C before going to bed. The next day I feel better.
 - Have I cured the common cold?
 - What are some alternate explanations?
- Alternate explanations:
 - sleep
 - immune system
 - cold medicine
 - probiotics
 - virus ran it's course

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Hypothesis vs. theory vs. laws – how are they related?



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Science doesn't "prove" anything!

- We only "support" or "fail to support" a hypothesis - why?



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Hypothesis vs. theory

A hypothesis is a proposed explanation for an observation.

- A valid hypothesis must be testable.

A theory is much broader in scope and explains a great many observations.

- Theories are supported by a large and growing body of evidence.

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1.8 Opening Questions: Why doesn't penicillin work as well as it once did?

Before 1940, millions of people died every year from common bacterial infections such as tonsillitis and strep throat. The discovery of antibiotics made these diseases treatable and we have come to expect protection against bacteria. However, today some of our antibiotics are no longer effective. What is going on?

Come up with a hypothesis to explain the increasing incidence of antibiotic-resistant bacteria.

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Scientists investigate the world in ways outside of the scientific method

- Not all science is hypothesis driven.
- **Discovery science** provides data used to describe the natural world.

Biologists take measurements and record data to help us better understand the natural world.



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Theory vs. theory

- Scientists use theory with a specific meaning.

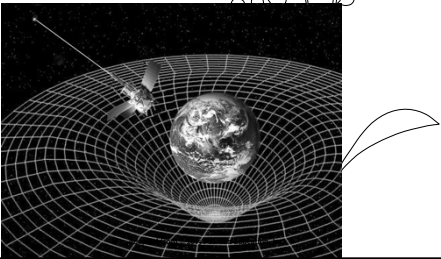
In everyday language how do people often use the word *theory*?

<p><i>Common Language:</i></p> <ul style="list-style-type: none">• Conjecture• Speculation• Opinion	<p><i>Scientific Language:</i></p> <ul style="list-style-type: none">• Well-supported• Testable ideas• Objective data
---	---

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• For gravity, we use Einstein's Theory of General Relativity to explain why things fall.

<http://news.nationalgeographic.com/news/2011/05/110510-einstein-theories-confirmed-gravity-theory/>



How are laws different from theories?

- Newton's Law of Universal Gravitation tells us that "Every point mass attracts every single point mass by a force pointing along the line intersecting both points. The force is directly proportional to the product of the two masses and inversely proportional to the square of the distance between the point masses."

= a calculation or formula

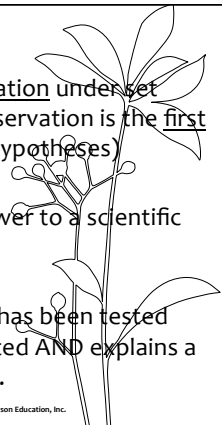
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Summary

A Law: A repeatable observation under set conditions. (note that an observation is the first step to making and testing hypotheses)

A hypothesis: potential answer to a scientific question.

A theory: a hypothesis that has been tested MANY times, always supported AND explains a broad range of observations.

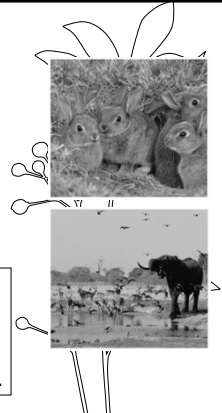


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Darwin's observations:

1. Every species has the potential to increase its numbers very rapidly by **exponential growth**.
2. For all organisms, **resources** (food, shelter, sunlight) are limited.

From these two observations, Darwin concluded **competition** is a factor for all living things.

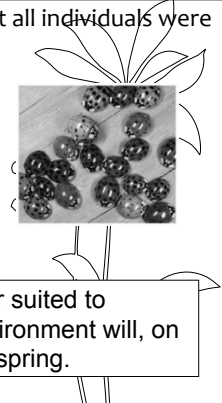


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1.7 Darwin understood that not all individuals were equally successful

- Heritable **variation** means that not all individuals are alike.
- Some individuals leave more offspring behind.


Individuals with traits better suited to compete in the current environment will, on average, produce more offspring.



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1.7 Darwin reached a profound conclusion:

- Darwin called the nonrandom unequal reproductive success among individuals **natural selection**.




Natural selection is not random because it favors individuals with traits that increase survival and reproduction.

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1.7 Darwin understood how natural selection could explain evolution

- Darwin realized that traits that enhance survival and reproduction will increase in frequency over time.
- **Adaptation** is the accumulation of favorable traits.



Darwin proposed that natural selection will result in "**descent with modification.**"

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