

What is life?

Dictionary: the quality that distinguishes living organisms from dead organisms!

What do all living things have in common?

Life on mars?

Evidence: Martian meteorite contained

1. Biotic mineral combinations
2. Bacteria poop: polycyclic (not the full note)
3. Bacteria-like structures

Organisms on Earth/ Characteristics of life

1. Cellular organization- can be higher number of chemicals on the inside as opposed to the outside (maybe 50)
 - Chemically complex
 - Bounded by a lipid barrier
 2. Metabolism: use nutrients and energy for repair and growth
 3. Reproduction
 4. Heredity: All life uses interactions encoded in DNA
 5. Evolution: All life changes over generations
- How they evolve depends on the forces of natural selection.
Must evolve from a common ancestor

Course Objectives

1. Learning biology

- Vocab
- Processes
- Application

2. Learning to think like a biologist

- How?
- Why?
- ^Evolution

-Scientific Method

1. Deductive Reasoning- solve specific problems using general principles
 - ^How theories are tested
2. Inductive Reasoning- infer general principles from specific examples
 - ^how theories are constructed

Constructing Theories

Make models: Simplified ideas of how things work

- Good scientists recognize the essentials
- Curie & Radium

Two Sources of Data

- 1) Observations
 - Age of meteorite
 - bug poop
 - Fossils
- 2) Experiments
 - Hypothesis testing

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Theory- a hypothesis that has not been falsified after many tests

- 1) Hypothesis
- 2) Predictions
 - General

- Specific
- 3) Experiment
 - Protocol
 - Data to collect
 - Analysis
- 4) Predicted Results
 - Must know likely results to tell if it was done correctly
- 5) Controls
 - Same expt except tested variable

Francesco Redi: Spontaneous generation of maggots

Observations:

-Flies swarm meat

-Maggots appear on meat

Hypothesis: Flies make maggots

Prediction: No flies, no maggots

Experiment: Cover meat

Control: Some meat uncovered

Results: none on covered meat, lots on control

Interpretation: Flies make maggots

Evolution by Natural Selection

-Most important theory in biology

Backgd:

-Late 1700s observations tested belief God made Earth (4,000 years ago)

-Geology: Earth changed

-Fossils: organisms changed

Jean-Baptiste de Lamarck 1744-1829

"evolution explains fossils"

-organisms gradually improved

Why? Striving for perfection

How? Changes acquired in life were passed to progeny

Charles Lyell 1797-1875

Described how earth changed slowly

Thomas Malthus 1766-1834

Organisms grow exponentially

Food grows arithmetically

-unchecked organisms would cover earth

-Population starves first

^Mechanism for Natural Selection

Charles Darwin 1809-1882

Evolution by Natural Selection

-Told how and why

-Hired as naturalist on 5 year trip on HMS Beagle

Observations on trip

1) Fossils- Fossil evidence of evolution

2) Species Varied

-each island had its own

-most like those on adjacent islands

3) Many species on young volcanic islands

-resembled mainland forms

More Evidence:

1) Comparative anatomy

-Homology- Vertebrate limbs

-Vestigial Structures

2) Embryology

3) Breeders: Selectively alter organisms

