

Important terms that are often misused:

- Fact: a data point, a well-confirmed observation
 - Lots of independent evidence
 - Unlikely to be overturned
 - NOT proof or truth
- Law: general statement describing some aspect of the natural world and how it behaves
 - Not known to vary
- Hypothesis: possible, tentative explanation of observations
 - May be weakly, well, or not supported
- Theory: very-well supported explanation
 - Relies on facts, laws, hypotheses
 - Supported by lots of observations
 - Supported by multiple lines of independent evidence

Facts and laws require explanations, hypothesis and theories provide explanations

Biology: science of living things/life

What is a living thing?

- Made up of one or more cells (the basic units of life)
- All use energy
 - Autotrophs: organisms that make their own energy
 - Plants
 - Heterotrophs: organisms that take energy from others
- Maintain homeostasis
 - Consistent internal conditions
- Ability to reproduce, grow and develop
 - Asexual or sexual
- Respond to environment/external stimuli
 - Respond to internal stimuli (what homeostasis is about)
- Posses a life cycle
- Adapt/evolve relative to their environment
 - Short-time and long-time scale
- Respiration
 - Maintains metabolism
- Highly ordered, but complex
 - Hierarchy to life

Hierarchy of life

- Cellular level
 - atoms → molecule → macromolecule → organelle → cell
- Organismal Level
 - Tissue → Organ → Organ system → Organ
- Populational Level
 - Population → Species → Community → Ecosystem → Biosphere

Evolution

- Definition: change in time
- Within biology, evolution has a dual nature
- Can be FACT
 - Observations, data points
 - These observations and data points change over time in living organisms
 - Well-confirmed
- Living things change over time
- Can be theoretical → explanation
 - Change of living things over time over a long time has generated the diversity that we see today

Evolution by natural selection

- First mechanism of evolution (natural selection) was not published until 1859 when Charles Darwin published *On The Origin of Species*
- Darwin-Wallace Theory of Evolution by Natural Selection
 - Alfred Russel Wallace
- Where did Darwin's ideas come from?
 - Served for five years on the HMS Beagle (1831-1836)
 - Several pivotal events occurred on this voyage:
 - The Earth was a lot older than he originally thought
 - Read *Principles of Geology* by Charles Lyell
 - Recognized that there was enough time for natural selection to occur
 - Fossils resembled modern organisms, currently living species
 - Recognized potential for shared ancestry/relatedness
 - Similar species varied from place to place in ways that suited their environment
 - Could mean that organismal change from common ancestor could be affected by environment
- Darwin... after the Beagle... came up with some observations
 - One major conclusion that he took from his time abroad, was even though organisms of the same species look very similar, they are not identical
 - Always slight variations in morphological characteristics/features of all creatures
 - Four postulates (ideas) that Darwin used to lay out evolution by natural selection
 - Postulate #1: Individuals within species are variable
 - Variation may have no impact on organism, but can also be advantageous or disadvantageous
 - But sometimes, variation results in an individual having an advantage

- o Can lead to increase in survival and or increase in reproduction