

- Levels of biological organization (DIAGRAM): (biggest to smallest going down)
  - o Biosphere
  - o Ecosystem
  - o Community
  - o Species
  - o Population
  - o Multicellular organism
  - o Organ system
  - o Organ
  - o Tissue
  - o Cell
  - o Molecule
  - o Atom
- Cell: smallest unit of life
  - o DIAGRAM: NUCLEUS IS PURPLE PART, CELL WALL IS FARTHER PART OUT, PLASMA MEMBRANE IS SECOND FURTEST PART OUT; ORGANELLES ARE GREEN AND BLUE PART
- Scientific method: 1) observation, 2) question, 3) hypothesis, 4) prediction, 5) experiments, 6) conclusion
  - o Experiment: must rule out the influence of other possible variables; controls are incorporated in; controls keep untested constant
  - o Limitations:
    - Can never be sure all untested variables are controlled
    - Conclusions based on experimental data must remain tentative
    - Results of experimentation must be communicated thoroughly and accurately to other scientists for repetition
    - Repetition by other scientists adds verification that findings can be used as the basis for further studies
- FRANCESCO REDI'S EXPERIMENT DIAGRAM: 6 STEPS OF SCIENTIFIC METHOD
  - o Disproved the idea of spontaneous generation
- Fleming's Discovery of Penicillin      DIAGRAM:
  - o PETRI DISH: BACK GROUND DARK BLUE PART
  - o BACTERIA: ZIG ZAG LIGHTER BLUE (TAKES UP MOST OF IT)

- o SUBSTANCE THE MOLD DIFFUSES OUT: RIGHT OUTSIDE WHITE MOLD
- o COLONY OF MOLD PENCILLIUM: WHITE SPOT
- Inductive reasoning: generalization from many observations
  - o LEFT, YELLOW SIDE STARTING WITH OBSERVATION → GENERALIZATION → PARADIGM ON DIAGRAM
- Deductive reasoning: generating hypotheses based on well-supported generalization (such as a theory)
  - o RIGHT, NEON BLUE SIDE STARTING WITH THEORY → PREDICTIONS → EXPERIMENT
- Evolution
  - o Charles Darwin & Alfred Wallace = basis of our modern understanding of evolution
  - o Arises as a consequence of three natural process:
    - Genetic variation: among members of a population
    - Inheritance: of those variations by offspring of parents carrying the variation
    - Natural selection: process where organisms with certain adaptations survive and reproduce more successfully than others
      - Preserves genes that help organisms flourish
      - Adaptations: structures, physiological process, or behaviors that aid in survival and reproduction; could be good for one environment may be poor in another
      - Species that can't adapt go extinct
      - Humans are responsible for accelerating the rate of environmental change
  - o DNA contains segments called genes (parents DNA is passed to offspring in accurate copying process)
    - DIAGRAM IS BLUE, GREEN AND RED DOUBLE HELIX WITH BLACK BACKGROUND
    - Mutation: errors in copy produce variety
      - Mutation is essential for living things to evolve
      - Arise from UV radiation or copying mistakes in DNA
      - Effects:
        - o No effect (harmless)
        - o A decrease in organism's ability to function

- o Death of the organism
- o An increase in an organism's ability to survive and reproduce (rare)
- Life: "the quality that distinguishes a vital and functioning being from a dead body" → life is difficult to define; certain characteristics define what is technically "alive"
  - o Characteristics define LIFE:
    - Structure is complex
    - Acquire materials and energy from the environment
    - Maintain internal conditions
    - Growth
    - Respond to stimuli
    - Reproduce
    - Capacity to evolve
  - o Complex and organized:
    - Salt: organized but simple (non-living)
      - ON DIAGRAM WITH BE THE LITTLE BLUE BOXES
    - Oceans: complex but unorganized (non-living)
      - ON DIAGRAM WILL BE A WAVE IN OCEAN
    - Water flea: complex and organized (living)
      - ON DIAGRAM WILL BE A LITTLE BUG
  - o Materials and energy are required to maintain organization, grow and reproduce
    - Nutrients: acquired from air, water, soil or other living things
    - Metabolism: sum total of all the chemical reactions needed to sustain life
    - Organisms obtain energy in two ways:
      - Autotrophs: make own food – "self feeders"
        - o Photosynthetic organisms that capture sunlight & store it in sugar & fats
        - o Includes plants, some bacteria, and some protists
      - Heterotrophs: eat others
        - o Organisms that acquire energy through ingesting molecules in the bodies of other organisms
        - o Includes many Achaeans, bacteria, protists,