01: The Science of Biology

Key Biology Terms

- **Binomial nomenclature:** A classification method using the genus and species names to name a living organism in Latin, invented by Linnaeus.
- **Cell:** The building unit for all living organisms that is capable ofperforming basic metabolism functions.
- **Autotroph:** Organisms that synthesize their own nutrients.
- **Heterotroph:** Organisms that depend on preformed organic molecules from the environment (or another organism) as a source of nutrients/energy
- **Evolution:** Living organisms have descended with modifications from species that lived before them
- **Gene:** Functional pieces of DNA that carry genetic information
- **Homeostasis:** All living organisms have the ability to maintain a relatively constant internal environment including water, salt, glucose and pH.
- **Hypothesis:** Attempt to explain why behavior occurs.
- **Theory:** Explanation of why behavior occurs that is supported by evidence.
- **Species**: The smallest group of living organisms that can mate and produce viable, fertile offsprings.
- **Kingdom**: The largest group of living organisms that share certain characteristics. There are only five kingdoms for all living organisms: Monera, Protista, Fungi, Plantae and Animalia.

What is a Life

Characteristic of a life:

- **Organization:** living things are well organized
- **Energy use:**living things need energy to support
- Reproduction: living things should be able to reproduce themselves
- **Growth:** living things grow and develop.
- **Response to stimuli:** living things can respond to internal or external stimuli
- **Homeostasis:** living things can maintain a relatively stable internal environment—self-regulation

Branches of Biology

- **Anatomy:** Study the structure and organization of lives
- **Biochemistry:** Study the chemical basis of life
- **Biology**: The study of life
- **Botany:** Study of the plantss.
- **Cell Biology:** Study of cell structure, cell cycle, cell function etc.
- **Development Biology:** Study how an individual organism grow and develop
- **Ecology:** Study a group of organisms interacting with each other and with their environment
- **Evolution:** Study how organisms acquire and inherit traits from their ancestors
- **Genetics:** Study of the inheritance at various levels (molecular, cellular, individual, population, etc).
- **Histology:** Study of the thin sections of tissues under a microscope
- **Marine Biology:** Study of the living things in the ocean
- **Microbiology:** Study microorganisms including virus, bacteria and some simply fungi
- **Molecular Biology:** Study of how bio-molecules interact with each other, particularly the molecules involved in transmission and translation of genetic information.
- **Physiology:** Study of the mechanical, physical, and biochemical functions of living organisms
- **Population genetics:** Study of gene variations and ratios among populations.
- **Taxolomy:** Study of classification of all living things
- **Zoology:** Study of animals.

Basic Theory of Biology

Cell Theory

- Developed by three German Scientists: Schleiden, Schwann and Virchow
- Cell is the building unit of all living organisms.
- All cells come from pre-existing cells
- All metaboism occur in cells of the body—cells are functional unit for all living things

Theory of Evolution

- All living organisms have descended with modifications from species that lived before them
- Natural selection is the driving force for evolution
  - All living organisms struggle for existence
  - All organisms can adapt to their environment
  - Better adapted individuals or species survive and poorly adapted ones become extinct—survival of the fittest.

Gene Theory

- Mainly contributed by Watson and Crick
- All genetic information is stored in DNA – genes
- Genes control most, if not every, aspects of an organism
- The DNA language can be transcribed into RNA language and then translated into protein language for its final function

Homeostasis

- All living organisms have the ability to maintain a relatively constant internal environment
  - Water and salt level
  - Blood glucose level
  - Body fluid pH
- Purpose: to ensure proper function of the body
- When it fails, a person can be sick or die

Classification of Living Things

All living things are classified into 5 kingdomes:

- **Monera:** single-celled, prokaryotic, photosynthesis or chemosynthesis
- **Protista:** single-celled or multi-celled; photosynthesis or absorbing nutrition from environment, eukaryotic, usually lives in water, autotroph or heterotroph
- **Fungi:** single-celled or multi-celled; photosynthesis or absorbing nutrition from environment, eukaryotic, heterotroph
- **Plantae:** multi-celled; photosynthesis, autotroph
- **Animalia:** multi-celled; hetertroph, capable of moving around

Scientific Processes

Although there is not one “scientific method,” there are aspects that are common to scientific investigations:

Forming a hypothesis:

- Observations
- Questioning
- Hypothesis formation

Testing a hypothesis:

- Experimentation
- Trend recognition

Evaluating a hypothesis:

- Conclusion formation
- Communication and validation of results
- Model formation
- Re-testing