

Biology

Range: 1.2 to 2.2

SCIENTIFIC METHOD

Independent Variable – a variable that is changed in the experimental

Dependent Variable – a variable that depends on the independent variable

Constant Variable – a variable that does not change throughout the experiment

CHAPTER 1

1.2 Classifying Life

The Characteristics of Living Beings:

- Cellular organization
- Energy usage
- Adaption to environments
- Response to surrounding stimulus
- Development
- Reproduction

Classifications:

Classification: the process of grouping things based on their similarities

Taxonomy: the scientific study of how organisms are classified

- *taxo-nomos*: arrangement science

Aristotle (Theophrastus afterwards) are considered the first taxonomists, as they organized organisms into:

- Animals: land/water/air
- Plants: herbs/shrubs/trees

Carolus (Carl) Linneaus invented the **binomial nomenclature** (*two-part naming system*) and is considered the Father of Taxonomy.

How to Write Binomial Nomenclature:

Balaenoptera Musculus – common name: blue whale

In type, you *italicize* the title, but in handwriting you underline it.

Remember that all scientific names are in Latin, and genera have to be capitalized; it can be abbreviated.

- E.g., *B. musculus*.

Taxon – A level of classification

There are 8 taxa:

- **Domain** – Eukaryotes // Prokaryotes
 - Eu–: Has a nucleus. Also has a complex structure
 - Pro–: No nucleus. Also has a simple structure
- **Kingdom**
 - Prokaryotic: Bacteria, Archaea
 - Eukaryotic: Protista, Fungi, Animalia, Plantae
- **Genus**: a classification containing similar, closely related organisms.
- **Species**: a group of organisms that can mate with each other and produce offsprings that can also mate and reproduce.

Humans' Official Name:

Domain	Eukarya
Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Primates
Family	Hominidae
Genus	Homo
Species	<i>H. sapiens</i>

Taxonomy on Paper:

Field guide: books with drawings that focus on differences between similar-looking organisms

Taxonomic key: a tool with several paired statements about the organism's characteristics

1.3 Domains and Kingdoms

The Omnipotent Table:

Domain	Kingdom	Prokaryotic/Eukaryotic?	Number of Cell	Ways to Make Food	Example	Additional Notes
Bacteria	Eubacteria	P	1	Auto/Hetero	<i>E. coli</i>	contains peptidoglycan on the outer coat
Archaea	Archaeobacteria	P	1	Auto/Hetero (chemosynthesis w/ hydrogen sulfide)	<i>P. abyssi</i>	Can survive in extremely harsh conditions – different chemical makeup from B
Eukarya	Protista	E	1/M	Auto/Hetero	Seaweed	Can be animal/plant/fungi like
Eukarya	Fungi	E	1/M	Heterotroph	Yeast	Chitin in the cell wall
Eukarya	Plantae	E	M	Autotroph (photosynthesis)	Dawn redwood	Chlorophyll
Eukarya	Animalia	E	M	Heterotroph	Coral (lul)	No cell wall

Prokaryotes:

- unicellular
- no nucleus nor any membrane-bound organelles
- cell is smaller and simpler

Eukaryotes

- cell has nucleus
- cell is larger and more complex

1.4 Evolution and Classification

Present Taxonomy:

- based on evolutionary history
- species with similar evolutionary history are classified more closely together
 - Evolutionary History can be determined by structure and chemical makeup

Evolution:

- 1859, British naturalist Charles Darwin published an explanation for how species change over time, which is called **evolution**, saying that it occurs by natural selection

Natural Selection:

- process by which individuals that are better adapted to their environment are more likely to survive and reproduce than other members of the same species
- causes:
 - overpopulation/environment change
 - struggle for existence
 - variation
 - survival of the fittest
 - evolution of new species

Determining Evolutionary Relationships:

- compare structure of organisms/information about the chemical makeup of the organism's cells
- homologous:
 - homologous structure: body parts that have same basic structure
 - organisms having homologous structures may have evolved from the same ancestor
- **convergent evolution**:
 - the process by which unrelated organisms evolve characteristics that are similar

Branching Tree Diagrams:

- **branching tree diagrams** show probable evolutionary relationships among organisms and the order in which specific characteristics may have evolved
- begin at base with common ancestor
- grouped accordingly to shared derived characteristics
- **shared derived characteristics**:
 - trait shared by all organisms
 - trait that the common ancestor of a group had, and passed on to all its descendants
 -

CHAPTER 2

2.1 Viruses

Viruses:

- **viruses** are tiny, nonliving particles that enter and then reproduce inside a living host cell
- are **parasitical**; depends on other living organisms (a **host**) for its existence in such a way that it harms the host organism
- have a protein coat that protects an inner core of genetic materials, cannot reproduce on its own

Virus shapes:

- many different shapes: sphere, rod-like, robot-like, etc. The average diameter of a virus is ~50–60nm.

Structure of Viruses:

- two (three) basic parts:
 - outer protein coat

- protection
 - invasion
- inner core
 - genetic material
 - DNA or RNA
- (outer membrane/envelope)
 - (lipid membrane)
 - (not all have)
- certain viruses can only attack certain cells
- each virus has unique surface proteins
- viruses recognize cells and can infect it by matching the surface marker with receptors stems on a cell (lock-and-key)

Virus Multiplication:

- steps:
 - a. virus attaches to host cell
 - b. DNA/RNA injected into cell
 - c. synthesis of viral genomes and proteins
 - d. assembly of new viruses
 - e. release of new viruses
- active viruses:
 - immediately multiply
 - quick death of invaded cells
- hidden viruses:
 - will "hide" before becoming active
 - E.g. Herpes Simples Virus (HSU)
 - cold sore
 - hidden

Naming Viruses:

- after the disease it causes
 - poliovirus
- organism it affects
 - tobacco mosaic virus
- place where the virus was first found
 - West Nile virus
- after people
 - Epstein-Barr virus

Viruses and Disease:

- some diseases, such as the cold, are mild and will pass through the body quickly
- others, such as HIV, will have more serious and long-lasting effects
- also causes diseases in organisms other than humans
 - e.g. apple mosaic virus, rabies, distemper

Usefulness of Viruses:

- gene therapy: viruses as messenger service to deliver genetic material to cells that need it

- **vaccines:**
 - is a substance introduced in the body to help produce chemicals that destroy specific viruses
 - usually a weakened or dead virus
 - do not cause disease
- Bacteriophages: viruses that kill bacteria

2.2 Bacteria

Cell Sizes:

- relatively small size (0.2–10 micrometers)
- greatly vary in sizes

Cell Shapes:

- spherical (cocci) (sussy? cock)
 - rod-like (bacilli)
 - spiral (spirilla)
- Cell's rigidity and chemical makeup determines a cell's shape

Cell Structures:

- **bacteria** was first discovered by Anton von Leeuwenhoek, a Dutch merchant in the 1600s
- cell wall
 - protect cell
- cell membrane
 - control the materials going in or out
- **nucleoid region**
 - Controls the bodily processes of the bacteria
- **cytoplasm**
 - gel-like fluid that moves structure throughout the cell
- **ribosome**
 - place where proteins are produced
- **flagellum**
 - helps cells to move
- **capsule**
 - only some have it
 - unite bacteria into colonies
 - protection from WBC
 - prevent bacteria from drying out
- **fimbria (pl. fimbriae)**
 - also called attachment pili
 - bristle-like
 - multiple on a cell
 - adheres to the host cell
- **pilus (pl. pili)**
 - also called sex pili, conjugation pili
 - bristle-like
 - exists singularly or in pairs

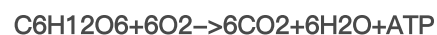
- longer than fimbriae
- adhere to another bacterium during DNA transfer

Obtaining Food:

- **Autotrophic bacteria:**
 - sun's energy:
 - cyanobacteria
 - halophiles
 - chemical substances:
 - sulfur bacteria
 - methanogen
 - **Archaeobacteria:**
 - sun's energy
 - halobacterium
 - chemical substances
 - **Eubacteria:**
 - sun's energy
 - cyanobacteria
 - chemical substances
 - **Heterotrophic bacteria:**
 - consume other organisms
 - consume food that other organisms make

Getting Energy:

- **cellular respiration:**
 - process of breaking down food to get energy
 - **aerobic respiration:**
 - cellular respiration using oxygen
 - **anaerobic respiration:**
 - cellular respiration without using oxygen



Reproduction:

- characteristics of living things
- 2 way of reproduction:
 - asexual – binary fission
 - i. bacteria starts to grow
 - ii. duplicate genetic materials
 - iii. formulation of septum, cell membrane and cell wall
 - sexual – conjugation
 - i. sex pili attach the donor cell to the recipient cell
 - ii. donor cell transfer one strand of a plasmid to the recipient
 - iii. a complementary strand of plasmid will be formed
 - iv. the recipient will have new genetic material
- **The Sex Table:**

Name	Binary Fission	Conjugation
Method	one divides into two identical cells	one cell injects its DNA into another cell through sex pili
Number of parents	1	2
Increase cell number?	Yes	No
Produce genetically new cells?	No	Yes
Environment	Favorable	Unfavorable

Endospores:

- small, round resting cell formed in bacteria
- formed when the environment is unfavorable
 - high/low temperatures, drought, no food/resources
- can survive for many years, multiply when the environment is favorable again

Uses of bacteria:

- **Beneficial:**
 - oxygen production
 - food production
 - health and medicine
 - environmental cleanup
 - environmental recycling
 - Cyanobacteria:
 - used to produce O₂ + make atmosphere form
 - now help keep the O₂ levels stable
 - Yogurt and cheese are all made with the help of bacteria
 - To keep food from spoiling, you can refrigerate it or pasteurize it.
 - help maintain homeostasis
 - There are bacteria in your digestive system that help digest and make vitamins.
 - They also are used to crowd out the bad bacteria
 - Used to make medicine
 - produce antibiotics and medicine
 - Fix N into N₂ for plants
- **Harm:**
 - food spoil
 - causes diseases