

Module 1 - Characteristics of Life

Characteristic	Example
Growth and Development	cell growth and cell division
Maintain Homeostasis	maintain appropriate concentrations of different chemicals, pH level, optimum temperature
Reproduction	succeeding generations through sexual or asexual processes
Response to Environment or Stimuli	adaptation to environment
Energy Processing	photosynthetic process
Organized	highly organized and coordinated cell structures

Terms

Specialization	adaptation of an organ or part to serve a special function
Meristematic Tissue	includes undifferentiated cells that are capable of specialization ; most action takes place here
Cytokinesis	physical separation of the two daughter cells; where cell division ends
Hibernation	state of minimal activity and metabolic depression
Torpor	involuntary and lasts for just a few hours during the daytime; not as heavy as hibernation
Piloerection	or goosebumps ; modification of the heat exchange, contraction of the musculi arrectores pilorum (MAP)
Autotrophs	organisms that can make their own food
Photosynthetic process	+ Oxygenic photosynthesis - Light energy transfers electrons from water to carbon dioxide in order to produce carbohydrates; seen in algae, cyanobacteria, plants

Terms (cont)

	+ Anoxygenic photosynthesis - light energy is captured and converted to ATP, without the production of oxygen ; doesn't have water as electron donor
Epithelial tissues	line the cavities and surfaces of the body such as the inside of the stomach and the outermost skin layer
Connective tissue	supports, protects and binds certain parts of the body such as muscles, together
Muscular tissues	produce movement by contraction and expansion
Nervous tissue	receive stimuli and conduct electrical impulses
Dermal tissue	forms outer covering of plants
Vascular tissue	moves water and nutrients through the plant
Ground tissue	makes up most of plants' bodies and performs majority of bodily functions
Vegetative organs	help sustain plant life; roots and leaves
Reproductive organs	facilitate either sexual or asexual reproduction; cones, flowers and fruits
Shoot system	parts above the ground; leaves, and stems
Root system	parts below the ground; roots and tubers
Diurnality	behavior characterized by activity during daytime, highly variable temperature
Crepuscularity	active primarily during the twilight period, coldest temperature is at dawn



Terms (cont)

Nocturnal behavior in animals characterized by being active during the night and sleeping during the day, constant temperature

Human body has 11 systems, while plants only have 2 (shoot and root)

Life Processes

Movement transfer places with the use of specialized structures like flagella, cilia and pseudopodia

Respiration exhibits a metabolic pathway that breaks down glucose and produces adenosine triphosphate (ATP)

Sensitivity act on sensing a stimulus and at the same time responding to it

Growth increase the size of each individual cell or increase of the number of cells

Reproduction formation of new cells by the process of cell division to replace or repair old cells

Excretion get rid of by-products due to metabolic processes which maybe toxic

Nutrition break down food, into simple molecules that can be absorbed and be utilized

Module 2 - Cell Theory

Development of Microscope

Zacharias Janssen Dutch spectacle-maker who discovered the first compound microscope which was later disputed

Galileo Galilei able to make his own microscope because of his knowledge about glass and focal lengths

Antony van Leeuwenhoek "Father of Microbiology", able to discover bacteria and protozoa; called bacteria "animacules"

Robert Hooke coined the term "cell"; published "Micrographia" in 1665

Formation of Postulates

Module 2 - Cell Theory (cont)

Matthias Schleiden German botanist, noticed that plants are made up of cells

Robert Schwann concluded that animals are made up of cells; coined "Schwann cells", which myelinates the axons of the peripheral nervous system

Rudolf Virchow "Father of Modern Pathology", published "Virchow's archives" and the aphorism "every cell stems from another cell"

Postulates of Cell Theory

1. All known living things are made up of cells.
 2. The cell is a structural and functional unit of all living things.
 3. All cells come from pre-existing cells by division.
- Additional:
1. All cells contain hereditary information which is passed from cell to cell during division.
 2. All cells are basically the same in chemical composition.
 3. All energy flow of life occurs within cells.

Module 3 - Prokaryotic vs. Eukaryotic cells

All known life are classified into 3 domains: Archea, Bacteria, Eukarya. The organisms in **Archea and Bacteria are prokaryotes** while the organisms in **Eukarya have eukaryotic cells**.

Prokaryotic cells - simpler and lack the membrane-bound organelles and nucleus; more primitive than eukaryotes, single-celled.

Eukaryotic cells - single or multicellular

Major Difference in Cell Structure

Eukaryotes store their DNA as chromosomes within the nucleus but prokaryotes lack the nucleus. Instead, the majority of their DNA is in the **nucleoid**. Additional DNA pieces, called **plasmids**, are shaped like rings and reside outside the nucleoid in the cytoplasm.

Differences in Organization

Eukaryotic cells use a specific cell division process called **mitosis**, while prokaryotic cells use **binary fission**.

-Prokaryotes create an exact copy of themselves; though genetic variance occur through **transduction**, which is when virus transmit plasmid containing DNA to bacterial cells (host).

-Eukaryotes sexually reproduce through **meiosis**, which maximizes genetic diversity and minimizes mutation.



Other Differences

Features	Prokaryotic	Eukaryotic
Protective layers	Capsule, cell wall and cell membrane	Cell membrane (animal cells), cell wall and cell membrane (plant cells)
Cell type	Usually unicellular (some cyanobacteria maybe multicellular)	Usually multicellular
Complexity	Simple	Complex organization
Nucleus location	Free in the cytoplasm, attached to mesosomes	Contained in membrane bound structure
Chromosome	Usually single circular without histones	Multiple linear with histones
Genes	Expressed in groups called operons	Expressed individually
Genome	DNA haploid genome	DNA diploid genome
Genome nature	Efficient and compact with little repetitive DNA	With large amounts of non-coding repetitive DNA
Movement	Simple flagellum, if present	Complex flagellum, if present
Respiration	Via cytoplasmic membrane	Via mitochondria
Energy production site	Electron transport chain located in the cell membrane	Within membrane bound mitochondria
Metabolic mechanism	Wide variation	Glycolysis, electron transport chain, Krebs cycle
DNA replication	Occurs in cytoplasm	Occurs in the nucleus
Transcription and translation	Occurs simultaneously	Transcription occurs in nucleus and then translation occurs in cytoplasm

Terms (cont)

Operon a functioning unit of DNA containing a cluster of genes under the control of a single promoter

Module 4 - Membrane-bound Organelles

Nucleus consists of nuclear envelope, chromatin and nucleolus; largest and contains genome

Endoplasmic Reticulum **major site of synthesis**, flattened sac network (cisternae). Its function is closely linked to that of the golgi apparatus and together they form the cell's secretory route

Rough Endoplasmic Reticulum takes proteins from the cytosol and continues its production in the golgi apparatus until completion

Smooth Endoplasmic Reticulum lipid, phospholipid and steroid synthesis

Golgi Apparatus packages macromolecules into vesicles; modifies proteins and lipids from endoplasmic reticulum

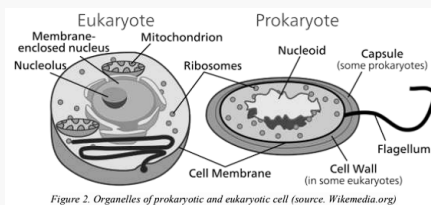
Mitochondria site of ATP synthesis; helps maintain the intracellular environment, has inner and outer membrane with an intermembrane space in between

Lysosomes acidic; contain numerous hydrolytic enzymes which catalyze hydrolysis reactions

Peroxisomes contain the enzyme catalase which decomposes hydrogen peroxide

Vacuoles acts as a storage for nutrients as well as waste materials to protect the cell from toxicity; helps in maintaining an **acidic internal pH**

Similarities between Prokaryotes and Eukaryotes



Both have DNA, plasma membrane, ribosomes for protein synthesis, and cytoplasm

Terms

Proteins comprise hundreds or thousands of smaller units called amino acids (20 types)

Carbohydrates provide energy, structural support and cellular communication; plant and fungal cell walls have carbohydrate cell walls

Lipids made up of fatty acids that can either be saturated or unsaturated

Nucleic Acids DNA and RNA

Archea single-celled microorganisms living in environments low in oxygen (extremophiles)

Flagellum specialized part used for movement

Cytoplasm jelly-like fluid within in a cell that is composed primarily of water, salts and proteins

Ribosome organelle used to synthesize proteins

Bacteria organelle used to synthesize proteins

Module 4 - Membrane-bound Organelles (cont)

Vesicles facilitate the storage and transport of materials in and outside the cell

Chloroplast produces amino acids and lipids required for the production of chloroplast membrane; has two distinct regions- grana and stroma

Terms

Cell compartmentalization process of selectively permeable nuclear envelope (separates the contents of the nucleus from the cytoplasm)

Gene expression involves first transcription, which is the mechanism by which **DNA is transcribed to mRNA**

pre-mRNA undergoes a process known as post-transcriptional modification where molecules are added or removed

Cytochrome p450 enzyme in SER; essential to some drugs and toxins, such as alcohol and barbiturates, in the metabolism

Exocytosis form of active transport and bulk transport in which a cell transports molecules out of the cell

Protein processing carbohydrate regions of glycoproteins are altered by addition, removal or modification of carbohydrates

Lipid processing adds phosphate groups and glycoproteins to lipids from ER (like cholesterol) to create the phospholipids that make up the cell membrane

Terms (cont)

Mannose 6-phosphate receptor lysosomal protein; binds newly synthesized lysosomal hydrolases in the trans-Golgi network and deliver them to pre-lysosomal compartments

Secretory proteins hormones; requires ATP, as it is necessary to fuse two negatively charged membranes to allow its release

Cell-surface proteins phospholipids; primary route of communication among the cells and the external environment

Porins protein in the outer membrane of nucleus; enable ion movement to and from mitochondrion

Phagocytosis important in killing mechanisms which are independent of oxygen

Tonoplast membrane which bounds the vacuole of a plant cell

Lamellar phase similar to plasma membrane; outer layer enclosing the liquid in vesicle

Grana made up of thylakoids; sight for the process of light-dependent reactions of the photosynthesis process

Stroma contains grana and is similar to the cytoplasm in cells in which all the organelles are embedded

Stroma Lamellae flat membranous tubules; connects the thylakoids of the different grana

Module 5 - Non-Membrane-bound Organelles

Ribosomes



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