UNIT I: Cell

All living things are made up of cell	Most cells are measured between 1 and 100 µm diameter
Uni-cellular organisms	mostly consist of bacteria.
Multi-cellular	compose of many types of cell.

Scientist

Robert Hooke	- one of the pioneers in studying cells create his own microscope.
	- an english scientist
	- one of the first person to perceive cell by slicing a very thin piece of cork and observe under microscope.
	- he observed, drew, and described what he saw and named it ***"cells"*** which derived from Latin word ***cella***, meaning "-small room" also ***cellulae*** which means six-sided cell of a honeycomb. All of this are written in his book ***Micrographia (1665)***.
	- he only saw the cell wall for cork cells are not alive.
Anton van Leeuwenhoek	- dutch naturalist, who was an expert in grinding lenses, created a microscope that can magnify things up to 270X.

Scientist (cont)

	- observing drops of rain water, he observed minute living organisms that he named ***"Animalcules"***.
Robert Brown	- in 1831, he discovered nucleus in plant cell. The nucleus contains the genetic information in an organism.
	- discovered the carrier of genetic materials called ***"Nucleus"***.
Felix Dujardin	- in 1835, French biologist, discovered the semi-transparent substance he called ***Sarcode*** which later changed to protoplasm.
	- discovered the ***"protoplasm"***.
Mathias Schleiden	- a German botanist, scrutinized and proposed his study about the plant.
	- he concluded that *all plants are made up of cell.*
Theodor Schwann	- in 1839, a German zoologist also observed and studied about the animal parts.
	- he concluded that *all animals are composed of cells.*
Rudolf Virchow	- in 1858, a German physician states that ***"All living cells come from other existing cells."***

Scientist (cont)

- this proof justify that the creation of new cells were came from other living cells.

Cell Theory

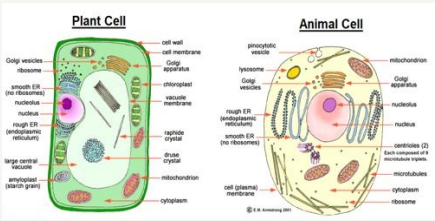
I **The Cell Theory states that:**

1. Cells are the building block and the functional unit of all living organisms it includes the life cycle, metabolic activities, and the ability to transfer character traits.
2. All living organisms are containing one or more cells.
3. Cells arise from the pre-existing cells.

I **Modern Cell theory:**

1. All living organisms are composed of trillions of cell in their body.
2. Cell is fundamental and building blocks of all living organisms.
3. Cells come from other cells by cell division.
4. The cell consists of genetic material which is passed from generation up to the last generation.
5. All cells are made up of the same in chemical composition.

Cell Morphology: Cell Structure and Function



Organelles

I Due to advancement of technology the study of cell and its structure broadens, this helps us to understand how cells work and how it affects our daily life.

I Also, we are now able to dissect and identify the different part of cell and its functions.

I This part of cell are called **ORGANELLES**.

Three major parts: Basic features of all cell type

Cell Membrane/Plasma Membrane	Cell membrane is made up of semipermeable membrane that actively facilitates the entrance and exit of materials in and out of the cell.
	This structure is compose of two layer of phospholipids (Phospholipid bilayer) fats, carbohydrates and protein materials.
Functions:	Provide support and maintain cell shape.
	Regulates the flow of material inside and outside the cell.
	Act as receptor site and functional carrier of molecule.
	And provide identification boundary.
Cell wall	This is the outermost layer of plant, fungal, and bacterial cell. (Not present in animal cell) .
	Gives additional support to the cell, prevent water loss and enclose the cell to avoid the invasion of pathogens.

Three major parts: Cytoplasm

Cytoplasm	Lies between the cell membrane and nucleus.
	Consist of a jelly-like substance.

Three major parts: Cytoplasm (cont)

	This is a place where cell expansion, growth, metabolic activities and cell function happens.
	Also consist of cytosol, organelles and inclusions.
Cytosol	Semi-transparent fluid present in which organelles are suspended. It also gives support and holds the organelles in the cell.

Cytoplasmic Organelles

Ribosomes	re small rounded, dark bodies, which contain proteins and RNA.
	They connect amino acids to form chains of proteins.
	Ribosomes does not have a membrane.
	Can be found in cytoplasm and Rough Endoplasmic Reticulum.
Endoplasmic Reticulum	Interconnected tubes and flattened sacs (cisternae) that transports vesicles to carry different substances.
	Comes in two types: Smooth ER and Rough ER
Rough ER	Has a ribosomes in its flattened body. Also manufacture and synthesize proteins.
Smooth ER	Has a NO ribosomes in its flattened body. It detoxify drugs and synthesize non-protein substance.

Cytoplasmic Organelles (cont)

Golgi Apparatus	A.K.A. Golgi Bodies, Golgi complex and Dictyosomes.
	Stacks of flattened sacs that carries protein from RER to the outside part of the cell.
	Contains enzymes that modify protein, packages and secreted protein.
	Vesicles are the small of packs of organic materials.
Mitochondria	It is known as the **"Power house of the cell"**.
	It has two layers of membranous sacs, the inside membrane is enfolds to form cristae and encloses by a matrix.
	This is the location wherein energy produces by synthesis of **Adenosine Triphosphate**.
	Organelle responsible for cellular respiration, conversion of energy originating from simple sugar and lipids into ATP energy. It regulates cellular metabolism.
Vacuoles	Single membranous sac that function as:
	Storage of materials and water
	Releases cellular waste products
	Conducts intercellular digestion

Cytoplasmic Organelles (cont)

	Maintains hydrostatic pressure.
Vacuoles in Plants	Plays large a vital role in turgor pressure and serves as for the storage of water.
Vacuoles in Animals	Relatively small compare to the vacuoles of plant, for storage of food products.
Lysosomes	These single-membranous organelles also digest damage parts of the cell down by nucleic acids and some lipids. The digested products can reuse again by the cell for the synthesis of cellular materials.
	Are known as "scavenger of the cell“
	Membranous bag structure which contain strong hydrolytic enzymes use to digest macromolecules.
Apoptosis	The programmed of cell destruction with the use of lysosomal enzymes is important in the process of cell development.
Glycocalyx	A.K.A. Cell Coat it is located in the outer part of cell membrane of animal cell.
	It functions for cell recognition and cellular adhesion.
	It is also responsible for tissue organization.

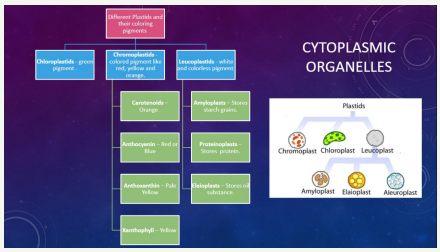
Cytoplasmic Organelles (cont)

Peroxisomes	Are membranous sacs that containing oxidative enzymes for the function of detoxifying harmful substance.
Cytoskeleton	Composed of collective network of protein filamentous, thread-like structure called microtubules, microfilaments which produce a strong ability to support and maintain the cell shape.
	It is the fundamental framework of the cytoplasm containing protein filament that assist for the organelles to move inside.
Plastids	The largest, rounded membranous organelles that contain DNA usually seen in plants but not common in animal cell.
	A double-membranous structure enclosed by a thylakoid membrane consists of chloroplasts which contain chlorophyll use by the plants for making coloring pigments in their food through the process of photosynthesis.
Thylakoid	Flattened membranous sacs.
Grana	Stacked arrangement of thylakoid.

Cytoplasmic Organelles (cont)

Stroma	Space outside the thylakoid which contains enzymes for carbohydrate synthesis.
Centrosome and Centriole	The centriole is a small, fibrous structure and cylindrical shape having a mass dense of protoplasm found near the nucleus.
	Contains nine pairs of peripheral microtubules orthogonally arrange to produce the wall of the cylinder.
	Present only in animal cell, a pair of centrioles are found inside centrosome which replicates when the cell divides.

Different Plastids and their coloring pigments



Cell headquarters: Part of Nucleus

Nuclear Envelope	Consists of two-membranous layer that covers the entire nucleus.
	It contains thread-like materials called chromatin which is located in a darker area of the nucleus.
	The nuclear membrane controls the continuous flow of materials inside and outside the nucleus.

Cell headquarters: Part of Nucleus (cont)

**Nucl-eoplasm	Or nuclear sap, contains fluid substance that suspended in the internal part forming the protoplasm of the nucleus also known as **Karyoplasm**.
Nucleoulus	A spherical shape made up of granular structures that found inside the nucleus containing Ribosomal Nucleic Acid (RNA) which rich of protein materials for the protein synthesis and carrying hereditary traits.
Chromo-somes	These are long thread stands associated with protein materials that suddenly coiled, appear thicker, denser and shorter when cells divide.
	Carries DNA
	Also bounded with protein which serves as packaging of deoxyribonucleic acid (DNA) that controls the hereditary characteristics.
Flagella	Cytoplasmic projections that made of two central and nine pairs of peripheral microt-ubules which extend from surface of cell; covered by plasma membrane; many single-celled organisms use them for propulsion and other function of flagella for cell locomotion.

Cell headquarters: Part of Nucleus (cont)

Cilia	Relatively short projections that extend from the surface of cell and allowing the materials to move on surface of some tissues in form of waves.

Prokaryotic vs. Eukaryotic Cells

- The distinction between **prokaryotes** and **eukaryotes** is considered to be the most important distinction among groups of organisms. **Eukaryotic cells** contain membrane-bound organelles, such as the nucleus, while **prokaryotic cells** do not.
- Differences in the cellular structure of prokaryotes and eukaryotes include the presence of *mitochondria* and *chloroplasts*, the *cell wall*, and the structure of *chromo-somal DNA.*
- **Prokaryotes** were the only form of life on Earth for millions of years until more compli-cated **eukaryotic cells** came into being through the process of *evolution.*

Prokaryotic Cells vs. Eukaryotic Cells

Characteristics of Prokaryotic Cells	Characteristics of Eukaryotic Cells
Less complex	More complex
No nucleus	True nucleus
Mostly unicel-lular	Either unicellular or multicellular
Bacterial cell wall – Peptid-oglycan	Plant cell wall – cellulose Fungi – chitin
Has a long single strand of DNA plus	Has two to hundreds of chromosomes per cell
70's ribosomes	80's ribosomes
Asexual reprod-uction by fission, Sexual production unkown	Asexual reproduction by mitosis and Sexual reproduction by fusion of gametes

Prokaryotic Cells vs. Eukaryotic Cells (cont)

Kingdom Monera (bacteria and cyanobacteria)	Kingdom of Animalia, Kingdom of Plantae and Kingdom of Fungi

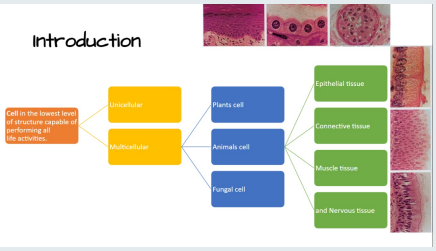
Prokaryotic Cells vs. Eukaryotic Cells

Cell Structure	Prokaryotic Cell	Eukaryotic Cell
Cell membrane	Yes	Yes
Cell wall	Yes	Depends on species
Centrioles	No	yes
Chromo-somes	One long DNA strand	Many
Cilia or Flagella	Yes, simple	Yes, complex
Endoplasmic Reticulum	No	Yes
Golgi complex	No	Yes
Lysosomes	No	Common
Mitochondria	No	Yes
Nucleus	No	Yes

Plant Cells vs. Animal Cells

Animal Cell	Plant Cell
Has no cell wall.	Has cell wall.
Relatively smaller.	Relatively larger.
Plastids are usually absent.	Plastids are present.
Many small vacuoles.	Has large central vacuoles.
Nucleus at the center.	Nucleus lies on one side of cytoplasm.
Centrioles are practically present.	Centrioles are normally absent.
Lysosomes are present.	Lysosomes are absent.

Cell Types



Epithelial Tissue

Epithelial Tissue	Form the covering of the surfaces of the body located both in internal and external parts.
	The cells making up the epithelium are often closely bound to one another through specialized structures called **Tight Junctions.**
Location:	External skin
	Inner lining of the mouth
	Digestive tract
	Urogenital tract
	Lining hollow part of every organ such as heart, lungs, eyes, ears
	Secretory glands
	Ventricular system of the brain and central canals of the spinal cord
	And the uppermost layer of the body, the skin.
Simple Epithelium	Epithelial tissue consist of single layer.
Stratified Epithelium	Epithelial tissue composed of many layers.

Two groups of Epithelial Tissue are Simple Epithelium and Stratified Epithelium, but sometimes epithelial tissues are group by: cell layer, cell shape and its function.

Epithelial Tissues

Squamous Cell	Squamous epithelia are found in places where rapid diffusion is required. It is also called pavement epithelium due to its tile-like appearance.
Descri-ption	Thin, scaly – look.
	Flattened on the surface.
	Fried egg appearance.
	With rounded nucleus
Location	Kidney glomeruli
	Air sacs
	Lining of heart
	Blood vessels
	Lymphatic vessels
	Lining of the ventral body cavities
Function	Diffusion
	Filtration
	Secretion
	Protection
Cuboidal Cell	An epithelial cell shaped like a cube. This is one of the closely packed cells forming the epithelium.
Descri-ption	Dice-shape/ Square like shape.
	With large and spherical nucleus.
Location	Kidney Tubules ducts and secretory position of small glands
	Egg cells
	Sperm cells
Function	Secretion

Epithelial Tissues (cont)

Columnar Cell	Are epithelial cells which have elongated shape with a height about 4 times the width. They are normal part of functional breast ducts but sometimes they develop in unusual ways or grow more rapidly than one would expect.
Descri-ption	Taller rather than wide.
	Column in shape long and rectangular shape with oblong nuclei or elongated nucleus contain goblet cells.
Location	Digestive Tubes
	Gallbladder
	Excretory Ducts
	Some glands
	Bronchi
	Uterine tubes
	Uterus
	Nose
	Ears
	Tongues
Function	Absorption
	Secretion
	Reception
	Sensory

Epithelial Tissues (cont)

Ciliated Columnar Cell	Moves mucus and other substances via cilia and is found in the upper respiratory tract. They are the primary target of infection for common cold viruses such as corona virus, influenza virus and rhinovirus.
Description	Fine hair like projection.
Location	Nose
	Uterus
	Fallopian tubes
	Egg cells
Function	Move mucus and other substances across the cell, ciliary action.
Pseudo-stratified columnar cell	Are found in places such as the trachea and upper respiratory tract, where their cilia and mucous secretion help collet foreign materials so you can cough or sneeze them out.
Description	False stratification or appearance.
	Free surfaces with hair like projection.
	Nuclei seen at different level that contain goblet cells.
Location	Ducts of large glands
	Ductus difference
	Trachea
	Throat
	Mouth

Epithelial Tissues (cont)

Function	Filtration
	Absorption
	Secretion
	Ciliary Action

Connective Tissue

Connective Tissue	Connective tissue is use to connect, bind, holds, and support one part to another part of the body.
	This is the most vascularized and widely distributed inside the body.
	Supporting the muscles to produce movements, protect the internal organs, and connects the tissues.
	Characterized by a large percentage of living cells and non living material known as matrix which is made of ground substance and fibrous structure.
	Cells of connective tissue is widely apart with each other in a form of matrix.
Bone Tissue	Bone cell (osteocytes)
	Matrix: Hard or calcified
	It support, protects, provides lever , storage, hemato-poiesis (Blood production).
Blood Tissue	Red blood cell (erythrocytes), white blood cell (leucocytes), and platelets.
	Matrix: fluid matrix (plasma).
	To transport materials.

Connective Tissue (cont)

Cartilage Tissue	Chondrocytes
	Matrix: rubbery collagen, elastic fibrous secretion of chondroitin substance.
	To support and helps to provide structures.
Hyaline Cartilage	Chondrocytes
	Matrix: firm cartilaginous fiber.
	To support and cushion properties.
Fibrocartilage	Chondrocyte
	Matrix: Collagenous fibers
	Absorb compressive shock
Elastic Cartilage	Chondrocytes
	Matrix: elastic fiber.
	To support the external.
Areolar (loose) Tissue	Mast cell, WBC, fibroblast and macrophages.
	Matrix: Collagen fiber, elastic fiber and gel-like matrix.
	Holds and conveys tissue and organ.
Adipose Tissue	Fat cells (adipocytes)
	Matrix: Reticular structure with collagen fiber.
	Storage of lipids for energy building.

Muscle Tissue

Muscle Tissue	Muscle cells that designed for contraction and movement.
	These can help us to do work.

Muscle Tissue (cont)

	Muscle cells are also called the **muscle fibers**.
	Inside the muscle fiber consists of **sarcoplasm** known as the cell membrane, **sarcolemma** as the cytoplasm of the muscle cell and the cell body that containing nucleus located at the center.
Skeletal Muscle Tissue	Striated Voluntary Muscle
	Long cylindrical shape, bundle form, many nucleus, many striations.
	Muscle attached to skeleton.
Cardiac Muscle Tissue	Striated Involuntary Muscle
	Short branching shape, have few striations, single or two nucleus.
	Muscle of heart.
Smooth Muscle Tissue	Non-striated Involuntary Muscle
	Spindle in shape, no striations, single nucleus.
	Muscle of visceral organs.

Nervous Tissue

Nervous Tissue	Consists of two types of cells: Conducting cells and Supportive cells.
	Primary function is to receive stimuli and send the impulse to the and brain. The brain sends back a response via the nerves.

Two Types of Nervous Tissue

Nervous Tissue (cont)

Conducting Cells	**Neurons** are specialized to transmit information throughout the body.
Supporting Cells	Transport nutrients from the blood vessels to neurons.
	Guard against toxin by creating barrier to harmful substances.
Neuroglia	Surround neurons and provide support for and insulation between them.
	Glial cells are the most abundant cell types in the central nervous system.
Neurons	Are interconnected to transmit signal throughout the Nervous system.

Consist of two parts:

1. Cell body or Soma	Contains the nucleus. Controls the activity of neuron.
2. Axon	Conducts impulse away the soma.

Neurons are classified according to function and structure.

Base on Function

Afferent or Sensory Neuron	Sensory receptor to CNS.
Efferent or Motor Neuron	CNS to viscera, muscle or gland.
Intern-eurons	Connection between neurons.

Base on Structure

Unipolar	Single process emerging from the cell body.
Bipolar	One dendrite and one axon.

Nervous Tissue (cont)

Multipolar	Many dendrites and one axon.

Integration and **communication** are the two major functions of nervous tissue.