Discoveries

Cell	Robert Hooke, 1665
Living Cell	Leeuwenhoek, 1674
Nucleus	Robert Brown, 1831
Protoplasm (Cytoplasm)	Purkinje, 1839
Cell Theory	Schleiden, 1838, Schwann, 1839
Expanded Cell Theory	Virchow, 1855
Electron Microscope (Invention)	1940

Cell Membrane

The outermost part, covers the cell.
Separates intra-cellular material from extra--cellular material.
It makes the cell a separate entity.
Helps in transport -> selectively permeable membrane.
Uses enzymes and amino acids for transport using lock and key mechanisms.
Made of lipids and proteins.
Methods of transport -
1) Diffusion - O_2 and CO_2 moves through cell membrane. (A spontaneous movement of a substance from a region of high concentration to a region of low concentration. (Only if energy is provided.))
2) Osmosis - The movement of water from a region of low solute concentration to a region of high solute concentration through a selectively permeable membrane.
3) Active Transport - Nutrition absorption (Requires Energy)
Solutions -
Isotonic solution - Net osmosis = 0
Hypotonic solution - Endosmosis - Water moves in.
Hypertonic solution - Exosmosis - Water moves out.

Lipids

For the cell membrane, enzymes, and hormones. All are helped by lipids to be made, proteins are also used.
Proteins and lipids and building blocks, they are not combined.
The S.ER of liver cells plays a crucial role in detoxifying poisons and drugs.

Vacuoles

Storage sacs for solids and liquids.
In plant cells, they are very big and take the central position with occupies. The central vacuole occupies 50% to 90% of the space and displaces the nucleus to the side.
Plant vacuoles have sap which increases rigidity.
Important substances and other things and stored in plant vacuoles. (Amino acids, sugars, organic acids, and proteins)
In amoeba, vacuoles hold food.
it is used for water expulsion also.

Features

Types of Organisms	1) Unicellular - One cell
	2) Multicellular - Numerous Cells (Different cells have different purposes, the shape and size corresponds to this.)
Division Of Labour	Cells have the basic capability of sustaining themselves through division of labour. Cells contain cell organelles which have specific functions. All cells have same organelles, no matter the cell.

Cell Wall

Found in plant cells, certain bacteria (cyanobacteria - blue-green algae (Can conduct photosynthesis)), and fungi (Agaricus) (Made up of cellulose in plants).
Cellulose is a polymer of starch -> sugar.
Surrounds the plasma membrane of plant cells and provides tensile strength and protection against mechanical and osmotic stress.
One of the strongest natural materials on earth, it is not digested easily, this is why herbivores have long digestive systems.
Shrinking due to exosmosis is called plasmolysis. The cell wall retains its shape in this phenomenon. Osmosis can only occurs in living cells.

Cytoplasm

Cytoplasm and blood plasma are the same.
It replenishes the cytoplasm.
Plasma contains nutrients and waste.
Cytoplasm is a moving material, it is a platform for cellular activities.
It contains cell organelles.
Viruses don't have cytoplasm or cell organelles.
In prokaryotes which lack cell organelles, the cytoplasm conducts ATP synthesis and et cetera.
The cytoplasm contains nutrients, diffused CO_2 and O_2, proteins, fats, lipids, and water.

Golgi Apparatus

Discovered by Camillo Golgi (Mexican/Spanish).
Multiple flat sacs stacked on top of each other. (flat sac - cistern)
Sometimes, they are connected to ER, which makes a very complex membrane system.
it packages proteins (RER) and lipids and sends them out (SER).

Golgi Apparatus (cont)

ER -> Lipids and proteins -> packaged by GA -> Sent to destination.
In some cells, GA converts simple sugars to complex sugars.

Mitochondria

ATP synthesis, Kreb's cycle (2^{nd} stage)
The powerhouse of the cell.
Contains mitochondrial ribosome which makes RNA which can join to be DNA. It sends them through pores.
It converts pyruvic acid to CO_2 + H_2O -> more ATP.
It has two mitochondrial membranes. The outer membrane is porous, the inner membrane is folded. More surface area for more chemical reactions.
They can produce their own proteins.

Cell Organelles

In every cell:	Nucleus, plasma membrane, cytoplasm.
In most cells:	Golgi Apparatus, Endoplasmic Reticulum, Plastids, Lysosomes, Ribosomes, Vacuole, Cell Wall, Centrioles, Mitochondria

Nucleus

Contains nucleolus -> Chromosomes -> DNA -> Genes
Plays a major role in cellular activities and cell reproduction.
Acetocarmine, safranin, and methylene blue are used for staining cells.
Nucleus had a different chemical composition and appears dark when stained.
Nucleolus is covered by two membranes, its porous from transport.

Nucleus (cont)

Nucleolus is made up of chromatin fibres which arrange themselves to form chromosomes. This only happens during cell division.
Chromatin fibres are made up of DNA (Deoxyribo Nucleic Acid) -> Deoxy Ribose Sugar + phosphate + nitrogen base. It is a chemical chain made up of nucleotides.
Multiple nucleotides make one gene. DNA is a staircase structure. Each step is a nucleotide.
If RNA/DNA is suspended in the cytoplasm, it is a prokaryote. (Nucleoid)

Endoplasmic Reticulum

Tubes (sheets) around the nuclear area. It's a large network, it's membrane-bound.
They are like oblong bags or vesicles.
Two types-
Rough ER - Has ribosomes -> proteins -> to the nucleus.
Smooth ER - Doesn't have ribosomes. -> fats and lipids production -> membrane biogenesis -> manufacturing and repairing the cell membrane, transport of material through ER.

Lysosome

Sacs filled with digestive enzymes.
produced by RER.
Clears cells by digesting all foreign materials and worn-out cell parts.
Lysis - cutting
They burst the membrane and release the enzymes, they are called suicide bags, they will destroy the full cell if it is beyond repair.

Plastids

Only in plant cells.
Two types -
* Chromoplast -
It is pigmented, if it is chlorophyll, then it will be green and called chloroplast (It conducts photosynthesis CO_2 + H_20 -> $C_6H_{12}O_6$.
It can contain Xanthophyll (Yellow), Carotenoids (Red, Orange)
* Leucoplast -
Non-pigmented, white, colorless.
For storage, oils, starch, and proteins.
The grana are connected to the top and bottom. Grana are towers made up of disc-like thylakoids. Thylakoids have chlorophyll with traps like in light reaction. Plastids are filled with stroma (liquids). The bridges that connect the grana are called Stroma Lamella
Photosynthesis is a two-stage process, in grana (First stage, Light reaction (requires light)) and stroma (Second stage, Dark reaction).