Cell Ultrastructure
TRANSMISSION ELECTRON MICROGRAPHS
OF A TYPICAL PLANT AND ANIMAL CELL

ANIMAL CELL

PLANT CELL

OBSERVE THE DIFFERENCES
BETWEEN THE TWO TYPES OF CELL

Courtesy of Dr. Julian
Thorpe – EM & FACS Lab,
Biological Sciences
University Of Sussex
DNA is the material of heredity. DNA associated with histone protein molecules forms the chromatin of the non-dividing cell.
The nuclear envelope is a double-layered structure consisting of two adjacent membranes, 40 – 70 nm apart, forming a perinuclear space.

The envelope is perforated by pores, each about 50 – 70 nm in diameter.

The pores enable communication to occur between the nucleus and the cytoplasm.
ELECTRON MICROGRAPH OF CELL NUCLEUS
Courtesy of Electron Microscopy Unit
University of Lancaster

mitochondrion

nuclear envelope

nucleolus

chromatin
The mitochondria

Outer smooth membrane

Inner folded membrane

The folds are called cristae

The surfaces of the cristae are studded with minute spheres

Fluid matrix of outer compartment

Fluid matrix of inner compartment
The endoplasmic reticulum

Lamellae or flattened sacs of the endoplasmic reticulum each made up of two membranes

Ribosomes - sites of PROTEIN SYNTHESIS

Cavity of endoplasmic reticulum

Junctions between the lamellae of the endoplasmic reticulum
ELECTRON MICROGRAPH OF
ROUGH ENDOPLASMIC RETICULUM

cavity of endoplasmic reticulum  
ribosomes
The Golgi Apparatus exists as stacks of closely packed membrane bounded sacs or *cisternae*.

Clusters of “pinched off” portions of the Golgi body form a *satellite of vesicles* around the array of *cisternae*.

The Golgi Apparatus is highly developed in cells secreting *proteins* or *complex carbohydrates*.
ELECTRON MICROGRAPH OF GOLGI APPARATUS

stacked membranes

Golgi vesicles

Courtesy of Dr. Julian Thorpe – EM & FACS Lab, Biological Sciences University Of Sussex
Many of the thylakoids are stacked to form grana. A single granum contains a circular DNA molecule, ribosomes, and lipid droplets. The stroma also contains starch grains, ribosomes, and lipid droplets.
The photograph shown below details chloroplast structure as viewed with a transmission electron microscope.

- Chloroplast envelope visible as two membranes
- Stroma containing numerous small ribosomes
- Lipid droplets
- Lamellae connecting different grana
- A single Granum

Courtesy of Dr. Julian Thorpe – EM & FACS Lab, Biological Sciences University Of Sussex
Unlike the cell membrane, the cell wall is porous and freely permeable to water, ions, sugars and other essential nutrients.
In many cases, where adjacent plant cells are held together in a tissue, there is communication between the cells.

Adjacent cells are interconnected by fine strands of cytoplasm known as plasmodesmata.
Comparison of Plant and Animal Cells

DIFFERENCES BETWEEN ANIMAL AND PLANT CELLS

PLANT CELL

ANIMAL CELL
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Courtesy of Dr. Julian Thorpe – EM & FACS Lab, Biological Sciences University Of Sussex
The phospholipid molecule has a **polar** phosphate–containing head group and two hydrophobic **fatty acid tails**.

The tails vary in length and may have one or more **double bonds**. Each double bond creates a **kink** in the tail.

The differences in **tail length** and the presence of **double bonds** are important for influencing the **fluidity** of the membrane.
Membrane Structure

The hydrophilic head consists of a phosphate and glycerol group.

Two non-polar hydrophobic tail groups are bonded to the hydrophilic head group.

A double bond creates a kink in the tail.

Polar hydrophilic head group

Non-polar hydrophobic tail group
The lipid bilayer is, however, relatively impermeable to many important molecules. Proteins embedded within the bilayer are responsible for many of the cell’s transport functions. Lipid bilayers tend to close on themselves to form three-dimensional, sealed compartments. Such an arrangement is ideal for cell membranes as lipid bilayers tend to reseal themselves when they are disturbed or torn.

Knowledge of the chemical composition of cell membranes and the properties of bilayers led Singer and Nicholson to propose the FLUID MOSAIC MODEL of membrane structure.
Glycolipids play a part in communication between cells and cell to cell recognition.

Many glycoproteins function as surface antigens enabling cells to distinguish self from “non-self”.

Cholesterol molecules are positioned within the bilayer close to the fatty acid chains. These molecules partially immobilise these chains and help to stabilise the membrane.