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SCIENCE & TECHNOLOGY



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Chapter - 1

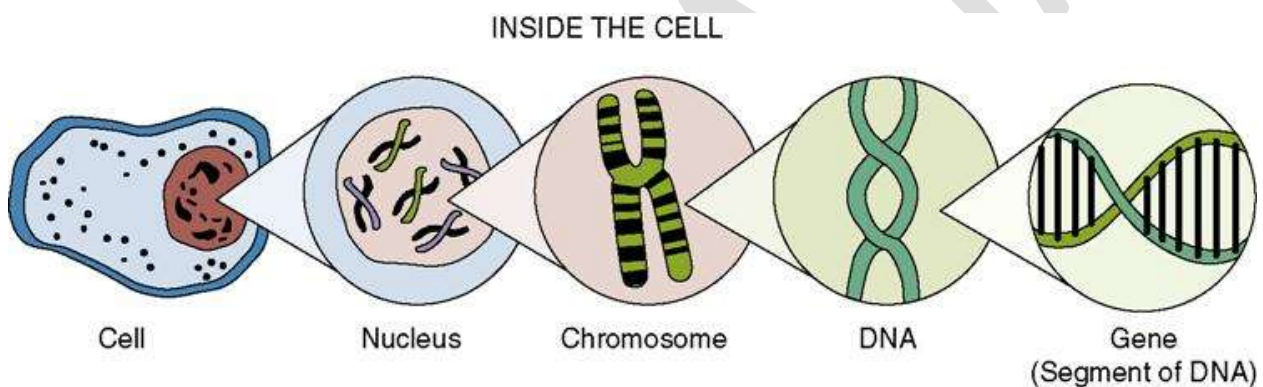
Biotechnology and its applications

Biotechnology deals with techniques of using live organisms or enzymes from organisms to produce products and processes useful to humans. Making curd, bread or wine, which are all microbe-mediated processes, could also be thought as a form of biotechnology. Such traditional processes usually utilize the living organisms in their natural form (or further developed by breeding), while the more modern form of biotechnology will generally involve a more advanced modification of the biological system or organism.

Various attributes of biotechnology: -

1. Cell: -

Cell is the basic structural and functional unit of life. Cells are basic building blocks of all living organisms. Cells make up tissues which make up the organs and then organ systems further on. The word 'cell' was first coined by British scientist Robert Hook in the year 1665.



Main features of the cell theory:

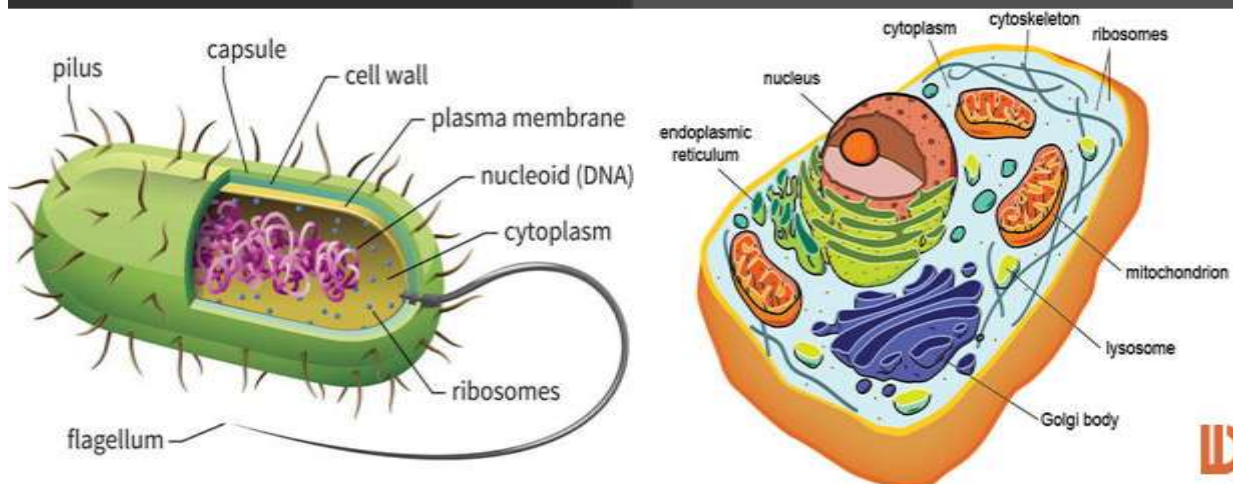
1. All organisms are composed of cells.
2. The body of every organism is made of cells.
3. Each cell arises from a pre-existing cell.
4. Every organism starts its life from a single cell.

Cells are of two kinds:

PROKARYOTIC CELL

VS

EUKARYOTIC CELL

**1. Prokaryotic cell:**

These are primitive cell having three basic structure of typical cell but lack nuclear membrane. Nuclear material is present in a region of cytoplasm called nucleoid. Other membrane bound organelles are absent such as mitochondria, lysosome, golgi bodies etc. Ex.-Virus, bacteria and cyanobacteria are Prokaryotes. Number of Mitochondria in bacterial cell is zero.

The smallest known prokaryotic organism is Mycoplasma. In photosynthetic prokaryotic bacteria chlorophyll is associated with membranous vesicles.

2. Eukaryotic cell:

These are complete cell which contain membrane bound organelles and nucleus. Unicellular and multicellular plant and animal have Eukaryotic cell.

The biggest single celled organism is Acetabularia. Nucleus contain chromatin made up of DNA and histone protein. Nucleolus is present inside nucleus.

Difference between Prokaryotes & Eukaryotes

S.	Prokaryotes	Eukaryotes
1.	Size of cell is generally small.	Size of cell is generally large.
2.	Nucleus absent.	Nucleus present.
3.	It contains single chromosome which is circular in shape.	It contains more than one chromosome.

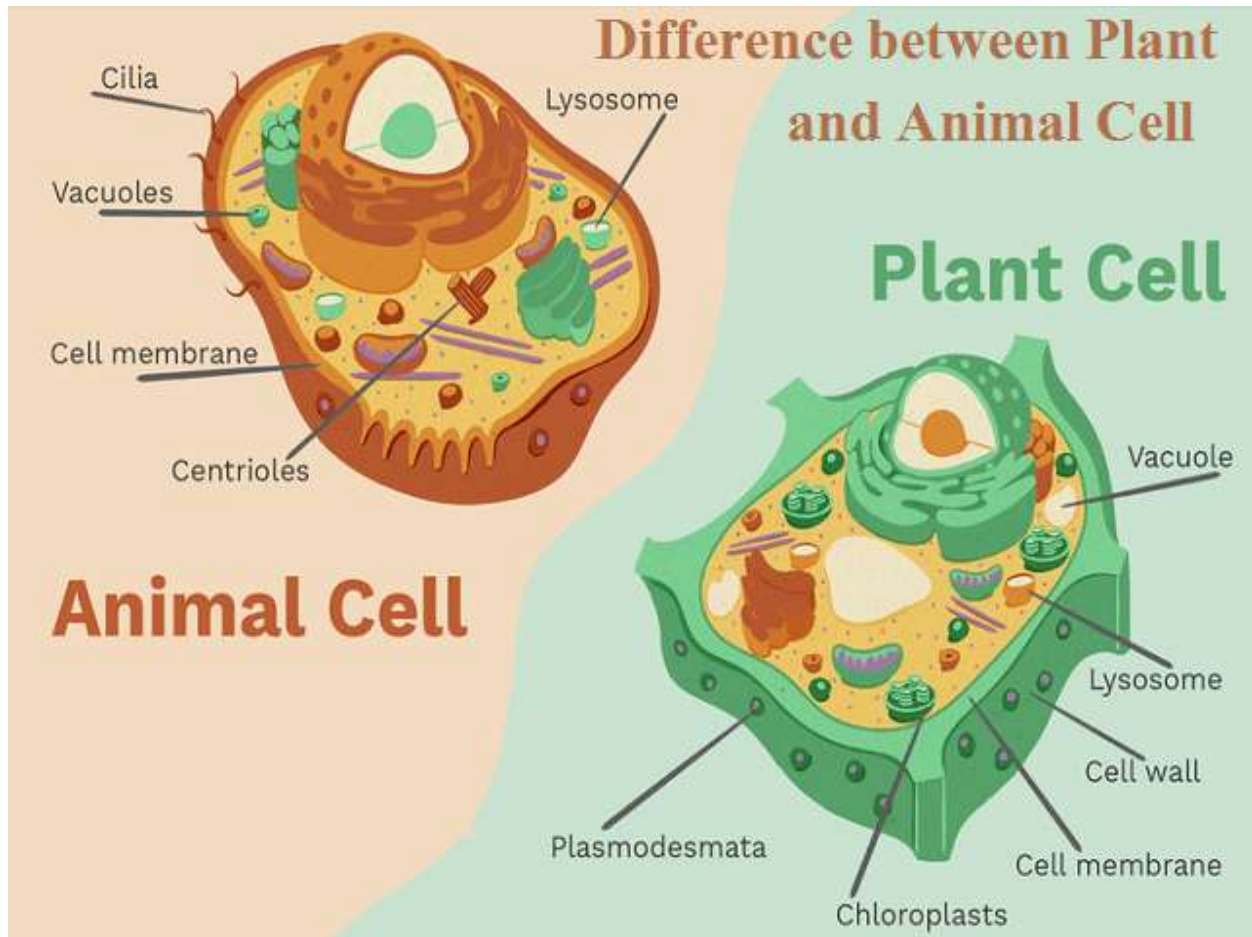
4.	Membrane bound cell organelles are absent.	Cell organelles present.
5.	Cell division takes place by fission or budding	Cell division takes place by mitosis and meiosis.

2. Cell Wall

A cell wall is defined as the non-living component, covering the outmost layer of a cell. Its composition varies according to the organism and is permeable in nature. The cell wall separates the interior contents of the cell from the exterior environment. It also provides shape, support, and protection to the cell and its organelles. However, this cellular component is present exclusively in eukaryotic plants, fungi, and few prokaryotic organisms.

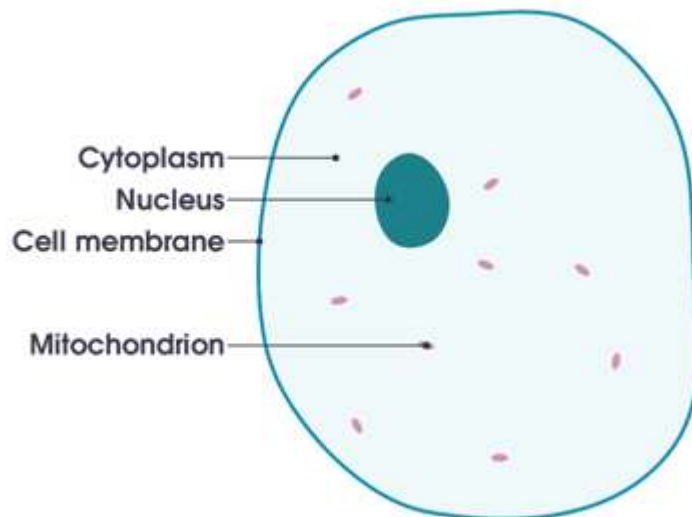
Difference between Plant and Animal cells

S.	Plant cell	Animal Cell
1.	Plant cells are larger in size.	Animal cells are smaller in size.
2.	Cell wall present, made up of cellulose and chitin.	Cell wall absent
3.	Plastid present.	Plastid absent.
4.	Centrosome absent.	Centrosome present.
5.	Vacuole are larger in size	Vacuoles are smaller in size.



3. Nucleus: -

Nucleus is a spherical, centrally located major structure found in the cell. In plant cell it is shifted towards periphery. It is bounded by double layered nuclear membrane having pore. Within nucleoplasm nucleolus and chromatin material is present. Nucleolus is rich in protein and RNA. Chromatin material is thin thread like structure forming network. This is made up of genetic substance DNA (deoxyribo nucleic acid) and histone protein. During cell division chromatin breaks into pieces and form chromosome.



Function: It controls all the activity of cells. So it is also known as 'control room' of cell. Chromatin transmits hereditary characters from parents to their offspring.

4. Mitochondria:-

Mitochondria are tiny rod-like structures in cells which act as power houses, generating the energy that allows our bodies to function. Unusually, they have their own DNA, distinct from the genetic material within the cell nucleus. Mitochondrial DNA (mtDNA) makes up about 0.1% of a cell's total DNA and does not affect individual characteristics such as appearance and personality.

5. Chromosomes:-

Chromosomes are thread-like structures found in the nucleus as chromatin material. It becomes visible during cell division. Each chromosome is made up of two chromatids joined together at a point called the centromere. Bead-like structures found on chromosomes are called genes. Genes are made up of DNA (deoxyribonucleic acid) which are the carriers of genetic information from generation to generation. In some viruses, RNA is the genetic material called a retrovirus. In prokaryotes, there is only one chromosome, like bacteria and viruses. Chromosomes are made up of DNA and protein. Chromosomes are the genetic material present in all cells.