CELL STRUCTURAL AND FUNCTIONAL UNIT

cell is the basic structural and functional unit of life.

cell -> tissue -> organ -> organ system -> organism (this is how cell is the structural unit)

cell does metabolic functions, produces glucose, energy(in the form of ATP[adenine triphosphate])

CELL SIZES AND SHAPES

smallest cell: mitoplasm(0.3 micrometer)

longest cell: neuron

largest cell: ostrich egg

CELLS IN ANIMALS

smallest cell in males: sperm

largest cell in males: WBC

smallest cell in females: RBC

largest cell in females: ovum

PLASTIDS

1) double membrane structure.

2) present mainly in plant cells and euglena(animal cell)

3) has its own circular DNA

4) ribosomes present are 70s

5) plastids generally have pigments which give them colour

- types of plastids -

1) leucoplasts: colourless, no pigment. **functions**: storage of starch(potato), proteins(pulses), oil(peanuts)

2) chromoplasts: coloured due to pigment. **functions:** to attract pollinators, nutritional value.

3) chloroplasts: green coloured due to chlorophyll. **functions:** photosynthesis.

LYSOSOME

1) single membrane structure.

2) also called suicidal bag.

3) membrane bound organelle having digestive enzymes.

4) absent in matured RBC and prokaryotic cells.

- FUNCTIONS -

1) cleans the cell by destroying worn out organelles.

2) destroys pathogens and toxic materials entering the cell.

3) they carry out autophagy -> destroying its own cell.

-steps of autophagy-

when a cell is damaged or infected -> lysosome enzymes gets activated -> lysosomes burst and digestive enzymes are released inside the cell -> the cell is digested completely.

DIFFUSION AND OSMOSIS

DIFFUSION	OSMOSIS
1) movement of substances from high concentration to low concentration.	1) diffusion through semi-permeable membrane.
	2) movement of substances from an area of higher concentration to an area of lower concentration through a semi-permeable membrane.
	-applications and importance of osmosis-
	1. absorption of water by root hair.

DIFFUSION AND OSMOSIS (cont)

2. unicellular organisms gain water through osmosis.

NUCLEUS

Control center of the cell.

common stain used for nucleus: acetocarmine

exceptions for nucleus: matured RBC of mammals, Platelets, Sieve tubes of phloem.

Covered by two membranes-> inner and outer membrane(together they are called the nuclear membrane)

ER is an extension of the outer membrane.

Nuclear membrane has openings called nuclear pores which contain Amuli.

Nuclear pore with amuli is called pore complex.

Nuclear pores allow passage of selective materials in and out of the nucleus.

nucleus contains a dense part called the nucleolus.

ribosomal subunits of rRNA are formed in the nucleus.

nucleolus is also important for protein synthesis.

nucleus is filled with jelly like substance called nucleoplasm/ karyoplasm/ nuclear sap. It contains all the components of the nucleus like nucleolus, chromatin fibres, enzymes, and nucleotids.

the nuclear membrane seperates nucleoplasm from cytoplasm.

nucleus contains thread like structures called chromatin. chromatin condenses during cell division to form chromosomes. chromosomes are strands of DNA wrapped around proteins called histones.

chromosomes contain genes that contain codes for protein synthesis.

ENDOMEMBRANE SYSTEM

1) organelles work together to make the cells work efficiently and properly

2) organelles who work together form this system. (functions of organelles depend on eachother)

3) organelles: ER, golgi body, lysosomes, vacuoles, etc.

CELL DIVISION

the process in which a cell divides to form two or four daughter cells.

cells which do not divide: RBC, WBC, Platelets, Neurons, Sieve cells.

- why is cell division important-

1. growth of organism.

2. to repair damaged tissue of the body.

3. to recover from injuries.

4. for production of gametes that help in reproduction.

DNA(DEOXYRIBOSE NUCLEIC ACID)

1) The universally accepted model of DNA is the double helical structure proposed by WATSON AND CRICKE.

2) adenine = thymine

3_ cytosine ≡ guanine

4. the functional unit of chromosomes are genes. Genes contain the code for production of proteins and is made of 3 alphabets .

5. DNA contains all the information necessary for the growth and development of the organism.

MITOCHONDRIA

1) powerhouse of the cell.

2) absent in matured RBC's, prokaryotic cell.

3) it produces energy in the form of ATP during cellular respiration.

4) stain used under microscope: Janus Green.

5) double membraned organelle.

6) semi autonomous organelle(does a few functions by itself)

-why is mitochondria a semi autonomous organelle?-

1) it has DNA and Ribosomes

2) it can sustain for 10 to 12 hours without the nucleus

3) it depends on the nucleus for some proteins.

4) it can produce certain proteins required for its metabolism.

GOLGI BODY

1) modifying and packaging unit.

2) absent in prokaryotic cells, matured sperms and matured RBC's.

3) consists of membrane bound sac-like structures called cisternaes, secretory vesicles.

4) single membrane structure.

5) it produces complex sugars from simple sugars.

6) it packs substances in secretory vesicles.

7) it gives rise to lysosomes.

8) it is a site for formation of glyco-lipids and glyco-proteins.

PLASMA MEMBRANE

1) made of lipids and proteins and some carbohydrates.

2) structure: sea of lipids in which proteins are present(phospho lipid bylayers)

PLASMA MEMBRANE (cont)

3) plasma membrane is a semi permeable/selectively permeable membrane.

4) it allows certain substances to pass through it.

- functions of plasma membrane -

1) movement of substances in and out of the cell. Higher concentration to lower concentration where ATP is not used.

ENDOPLASMIC RETICULUM

1) found in all plant and animal cells.

2) absent in mature RBC in mammals and prokaryotic cells.

3) gives rigid support to cells.

-ELEMENTS OF ER-

1) cisternae(RER): flat structures.

2) vesicles(SER): round and smooth.

3) tibules(SER): tube like structures.

- FUNCTIONS OF ER -

1) helps in the transfer of materials between various regions of the cytoplasm and between the nucleus and the cytoplasm.

2) RER helps in protein synthesis.

3) SER helps in lipid(fat) synthesis.

4) Biogenesis: process of producing lipids and proteins and using them to produce membranes of cells is called Biogenesis.

5) SER detoxifies drugs and poisons in the cell.

CHROMOSOMES

diploid: two sets of chromosomes, only in vegetative cells.	haploid/gametal cells: only one set of chromosomes.

chromosomes contain all the information required for growth and development of an organism.

TYPES OF SOLUTIONS

- ISOTONIC SOLUTI-ON(bal-anced) -	- HYPOTONIC SOLUTION (diluted)-	- HYPERTONIC SOLUTION(-concentrated) -
1. it has exactly the same water concen-tration as the cell.	1. it has more concen-tration of water than the cell.	1. it has less concentration of water than the cell.
2. so there is no net water movement across the cell.	2. water moves in the cell and causes the cell to swell.	2. water moves out of the cell and causes the cell to shrink.

DIFFERENCES BETWEEN PROKAR-YOTES AND EUKARYOTES

PROKARYOTES	EUKARYOTES
1. prokaryotes have a nucleoid and nuclear membrane is absent.	1. has a well defined nucleus with nuclear membrane.
2. lacks membrane bound organelles.	2. membrane bound organelles are present.
3. DNA is circular.	3. DNA is linear.
4. ribosomes are small(70s)	4. ribosomes are large(80s)
5. single chromo-somes are present.	5. multiple chromosomes are present.
6. cell wall is peptid-oglycan.	6. cell wall is cellulose(plants) and chitin(an-imals)

HISTORY OF CELL

robert hooke: discovered cork cell(which was dead) using a primitive microscope.

anton von leeuwenhoek; found free living cells in pond water using an improved microscope.

robert brown: discovered nucleus

purkinje: coined the term protoplasm.

schleiden and schwann: made the cell theory.

rudolph virchow: cell theory.

SOME TERMS

homologous chromosomes : chromosomes which are similar in structure and function.

crossing over: process of exchange of genetic material between non-sister chromatids of homologous chromosomes.

CENTROSOMES

1) present only in animal cells.

2) form spindle fibres during cell division.

TRANSPORTATION IN THE CELL

PASSIVE TRANSP-ORTATION	ACTIVE TRANSPORT-ATION
1. high concentration to low concentration.	1. low to high concentra-tion.
2) no energy is used.	2. energy used.
3) eg: diffusion, osmosis.	3. eg: reabsorption of substances in the kidney, sodium/potassium pump.

RIBOSOMES

1) found on the surface of ER.

2) freely found in the cytoplasm.

3) present in plastids and mitochondria.

4) sometimes found in the outer membrane of the nucleus also.

5) produced in the nucleolus of the nucleus.

6) made of RNA and proteins.

7) membrane-less organelle.

8) it has two subunits:- a small unit(70s) and a large unit(80s).

9) 70s ribosome: present in prokaryotic cells, mitochondria and chloroplast.

10) 80s ribosome: present in eukaryotic cell, ER, cytoplasm of ER, outer membrane of the nucleus.

VACUOLE

1) single membrane bound organelle.

2) types of vacuoles: food, gas, contracil-e(only in aquatic animals)

-functions-

storage, maintains water balance in the cell, helps in excretion.

DIFFERENCES BETWEEN MITOSIS AND MEOSIS.

mitosis	meosis
1) forms 2 daughter cells.	1) on cell forms 4 daughter cells.
2) also known as equational division.	2) also known as reductional division.
3) occurs in vegetative cells or somatic cells.	3) occurs in gametes or germinal cells

DIFFERENCES BETWEEN MITOSIS AND MEOSIS. (cont)

4) daughter cells have same number of chromosomes.	4) daughter cells will have half the number of total chromosomes.
5) helps in growth and healing of an injury.	5) formation of gametes for reprod-uction.

DIFFERENCES BETWEEN SER AND RER

SER	RER
1) ribosomes are present.	1) ribosomes are absent.
2) protein synthesis.	2) lipid synthesis.
3) mainly has cisternae.	3) mainly has vesicles and tibules.

CHROMOSOMES

during cell division, chromatin condenses to form chromosomes.

chromosomes contain DNA along with proteins called Histones which helps in the packing of DNA.

DNA is made of nucleic acids.

NUCLEIC ACIDS:

1) made up of sugar(deoxyribose sugar-> 5 carbon compound)

2) nitrogenous bases-> adenine, guanine, cytosine, thymine. (thymine is only in DNA, in RNA it is Uracil)

Adenine = Thymine (double bonding)

Guanine ≡ Cytosine (triple bonding)

DIFFERENCES BETWEEN ANIMAL AND PLANT CELL

plant cell	animal cell
1. nucleus is situated in the peripheral area.	1. nucleus is in the center of the cell.
2. cell wall is present.	2. cell wall is absent.
3. vacuoles are large and present.	3. vacuoles are small and temporary.
4. plastids are present.	4. plastids are absent.
5.lysosomes are absent.	5. lysosomes are present.
6. centrosomes are absent.	6. centrosomes are present.
7. cytoplasmic division happens by cell plate formation.	7. cytoplasmic division happens by cell furrow formation.

1. nucleus is in the peripheral area.

DIFFERENCES BETWEEN ANIMAL AND PLANT CELL

plant cell	animal cell
1. nucleus is in the peripheral area.	

THE CELL THEORY

1) every organism is made up of cells.

2) cells are the structural and functional unit.

3) all cells arise from prexisting cells. (omicellula-e-cellula

MODERN CELL THEORY ADDITIONS:

4) all cells contain genetic material.

5) some organisms can divide again and again and give rise to organs or organisms.