DR IMAN NABIL HISTOLOGY

The Cell

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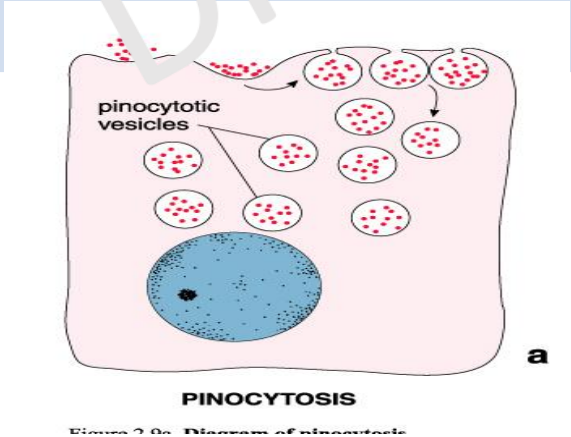
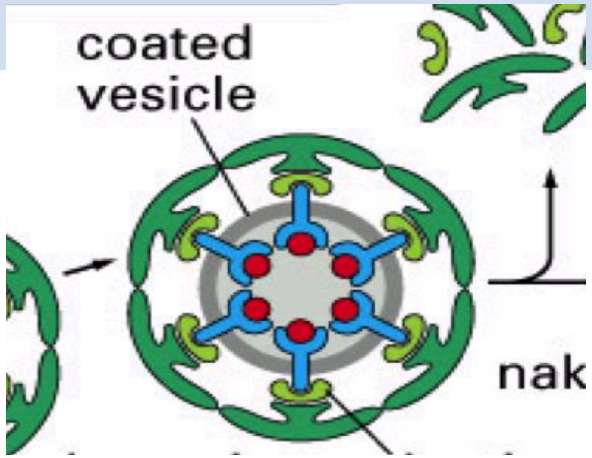
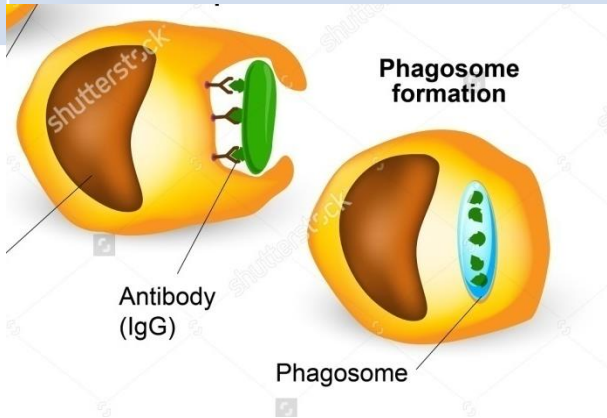
Types of endocytosis	Pinocytosis	Receptor mediated endocytosis	Phagocytosis
1- Endocytosed material	Fluid containing ions & small molecules.	Specific substances e.g. hormone.	Large solid particles e.g. bacteria.
2- Receptor-mediated	No receptors.	Receptor mediated(highly selective)	Receptor mediated.
3- shape of the vesicle	Small& smooth.	Coated with clathrin.	No coated vesicle, instead the membrane fused to form phagosomes.
4- Type of cells	Nearly all cell types especially endothelium of blood vessels.	Specific cell that has receptor for specific substance.	Phagocytic cell.
5- Pathway	Early endosome → late endosome → lysosome.	Early endosome → late endosome → lysosome.	Late endosome → lysosome.

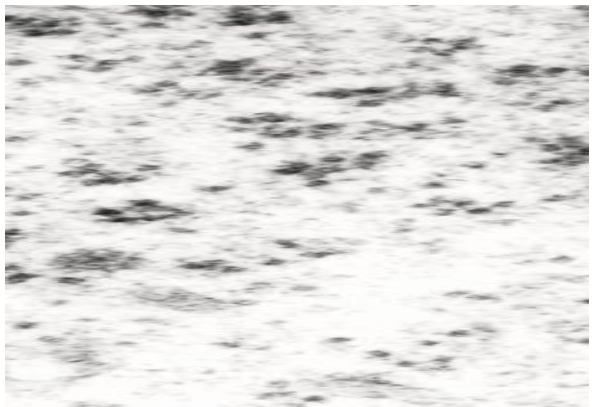


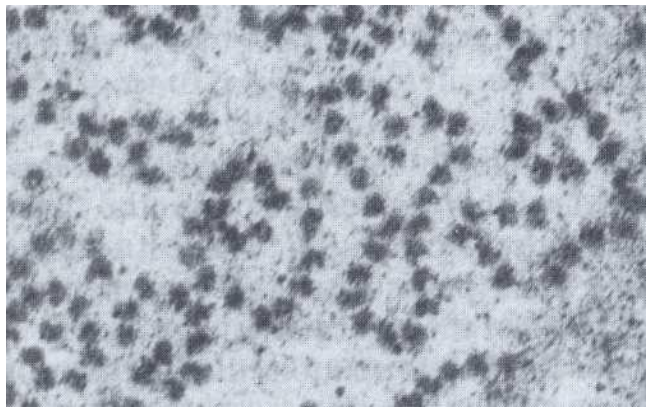


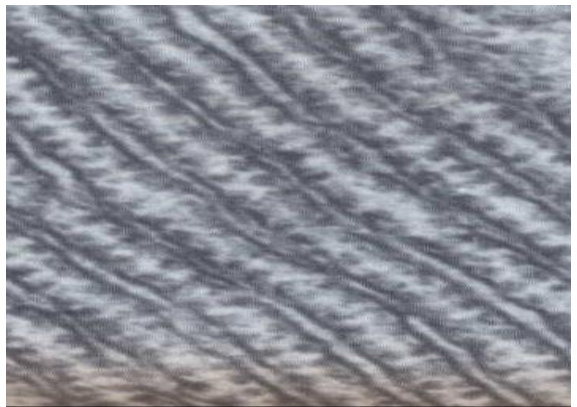


Types of exocytosis	Regulated secretion	Constitutive secretion
1- stimulus	Stimulus dependent.	No stimulus. They released continuously.
2- Secretory product	Concentrated & stored inside secretory granules.	Leave the cell membrane immediately after their synthesis. No secretory granules.
3- Example of the released secretion	Digestive enzymes from pancreatic cell.	Antibodies from plasma cell, & collagen from fibroblast.

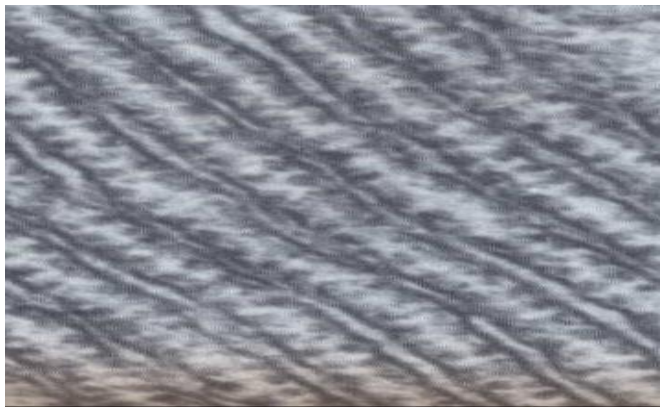
Types of ribosomes	Free solitary ribosomes	Free aggregated ribosomes (polysomes)	Attached ribosomes
1- LM		Not seen but in large amount give cytoplasmic basophilia.	Not seen but in large amount give cytoplasmic basophilia.
2- EM	Small electron dense particles.	10 or more ribosomes connected by a single strand of mRNA.	Small electron dense particles attached to rER.
3- Function	Reserve.	Synthesis of cytosolic proteins (used within the cell)	Synthesis of secretory proteins, lysosomal enzymes& membrane proteins.

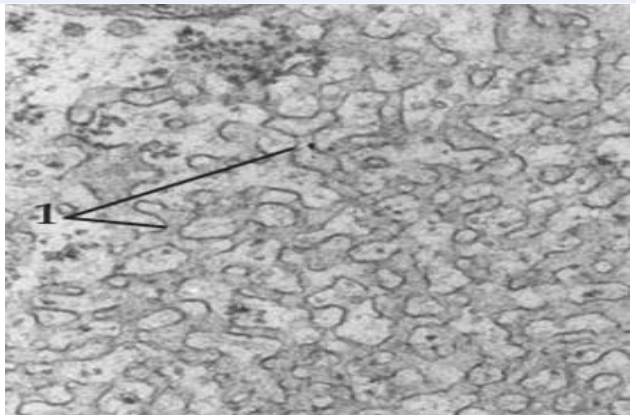




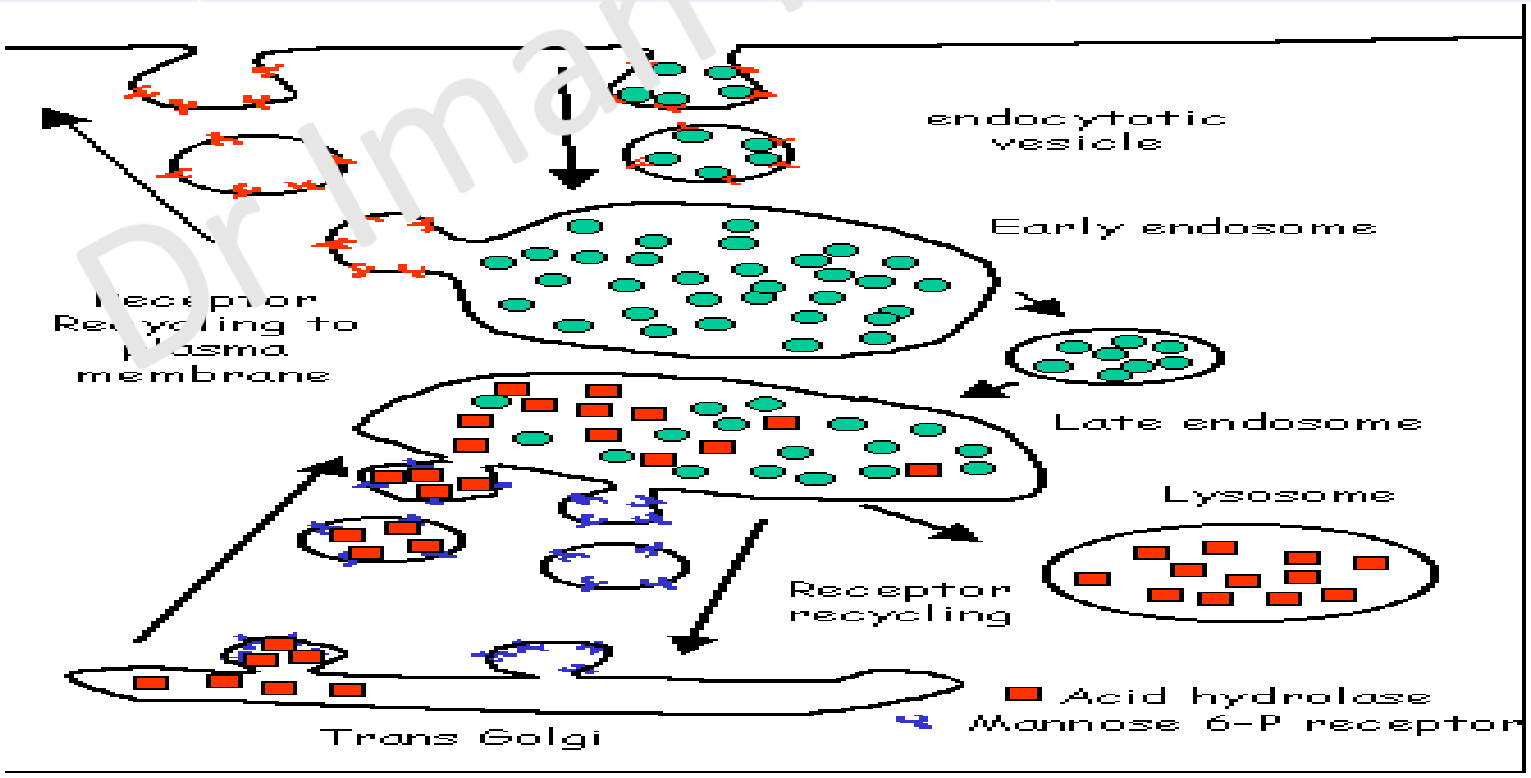


Types of endoplasmic reticulum	Rough endoplasmic reticulum	Smooth endoplasmic reticulum
1- LM	Not seen but in large amount give cytoplasmic basophilia.	Not seen but in large amount give cytoplasmic acidophilia.
2- EM	Parallel, flattened interconnected tubules. Studded with ribosomes.	Interconnected branching tubules and vesicles. No ribosomes.
3- Functions	1- synthesis of secretory proteins, lysosomal enzymes& membrane proteins. 2- Post translational modification of protein. 3- Transport protein to Golgi.	1- Synthesis of lipid & cholesterol of the cell membrane. 2- Synthesis of steroid hormones. 3- Synthesis of glycogen. 4- Detoxification of toxic substances. 5- Storage of calcium in muscles.
4- Sites	Protein secreting cells e.g. liver , fibroblasts.	Steroid secreting cells, liver & muscles.

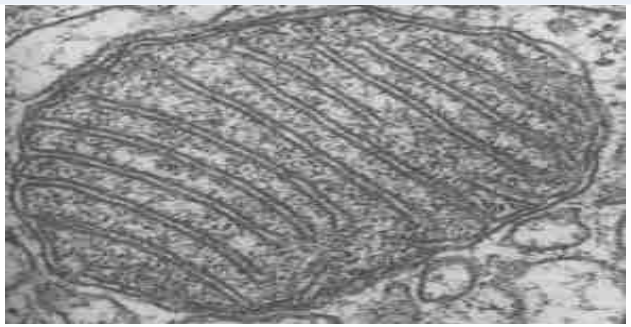


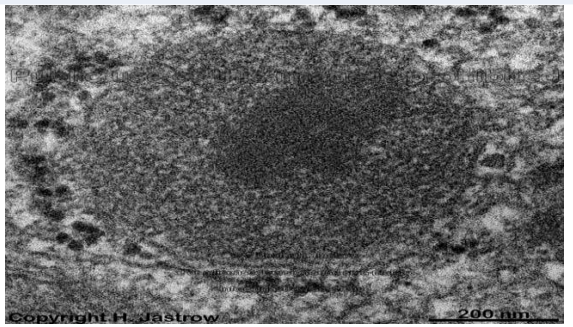


Types of endosomes	Early endosome	Late endosome
1-Site	Periphery of cytoplasm.	Deep in cytoplasm , near Golgi.
2- Content	Receptor ligand complex.	1- Ligands from early endosome. 2- Lysosomal enzymes from Golgi.
3-Function	Uncoupling of the receptor from ligand.	Lysosomal enzymes begin to degrade ligands, then the late endosome matures to lysosome.
4- pH	Less than 6.	5.5.



Energy producing organelles	Mitochondria	Peroxisome
1- LM	Not seen by H&E except in large amount cause cytoplasmic acidophilia. By special stain (silver stain) appear as brownish granules.	Not seen.
2- EM	Double membrane: outer is smooth and inner is folded into cristae enclosed matrix space.	Single membrane enclosed fine granular contents.
3- Function	Production of energy & store it in the form of ATP.	1- Produce energy & released it in the form of heat (unable to store it). 2- Produce hydrogen peroxide. 3- convert excess hydrogen peroxide into water. 4- Detoxification of toxic substances.
4- sites	All body cells except red blood cells & keratinocytes.	Many cells especially liver.





Types of DNA	Nuclear DNA	Mitochondrial DNA
1-Shape	Filaments.	Circular.
2- Percentage	Represents 99% of the total DNA of the cells.	Represents 1% of Total DNA of the cells.
3- Function	Encoding synthesis of most of the proteins inside the cytoplasm.	Limited coding capacity, encoding some of the structural proteins of the mitochondria.

How do mitochondria adapt to its function?

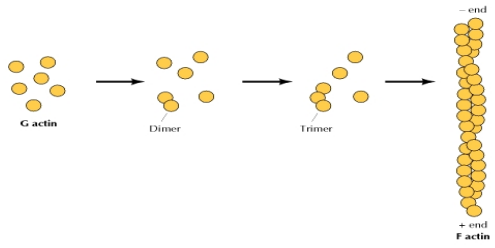
1- Outer membrane: smooth &porous contains mitochondrial porins → allow easy passage of small molecules.

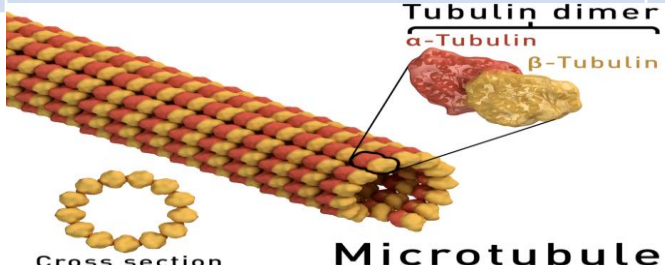
2- Inner membrane is folded into numerous cristae → increase surface area for energy production.

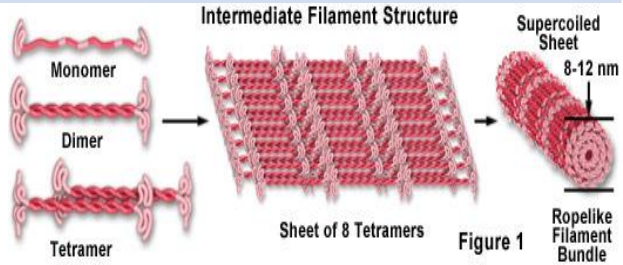
3- Inner membrane contains cardiolipin → make it highly impermeable to ions & small molecules.

4- Matrix space: contains enzymes for citric acid cycle, mito DNA & ribosomes → synthesize some of their structural proteins, also contains matrix granules → store Ca thus play an important role in regulation of intracellular Ca concentration.

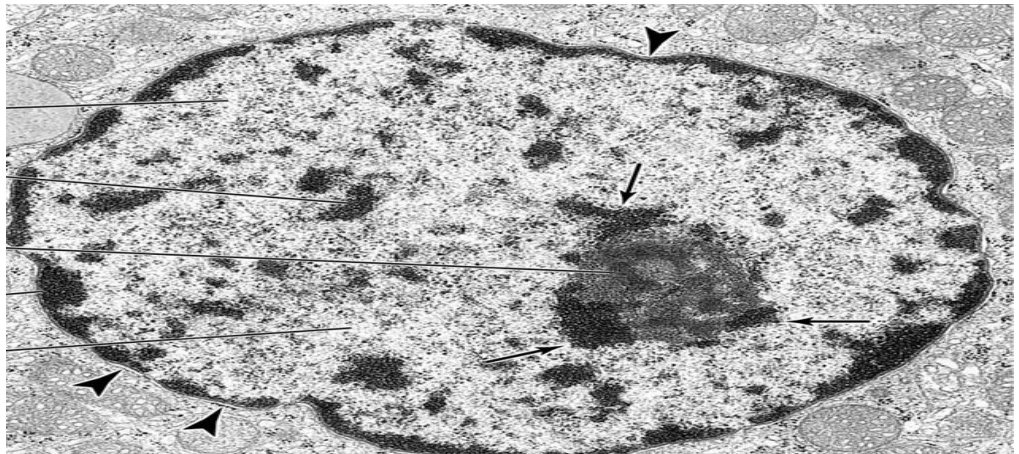
Types of cytoskeleton	Microfilaments	Microtubules	Intermediate filaments
1- diameter	7 nm.	25 nm.	10 nm.
2- LM	Seen only by immunohistochemistry.	Seen only by immunohistochemistry.	Seen only by immunohistochemistry.
3- EM	Thin electron dense filaments.	Fine tubules.	Thicker electron dense filaments.
4- Structural proteins	Monomers of G actin polymerize to form F actin.	Tubulin dimer polymerize to protofilaments. 13 protofilaments form a microtubule,	Woven ropes.
5- Functions	Dynamic 1- Muscle contraction. 2- Contractile ring in cell division. 3- Pseudopodia in migration. 4- Microvilli. 5- Cytoplasmic streaming.	Dynamic. 1- Transport of organelles & vesicles. 2- Formation of centrioles, cilia & flagella.	Not dynamic. Structural support.







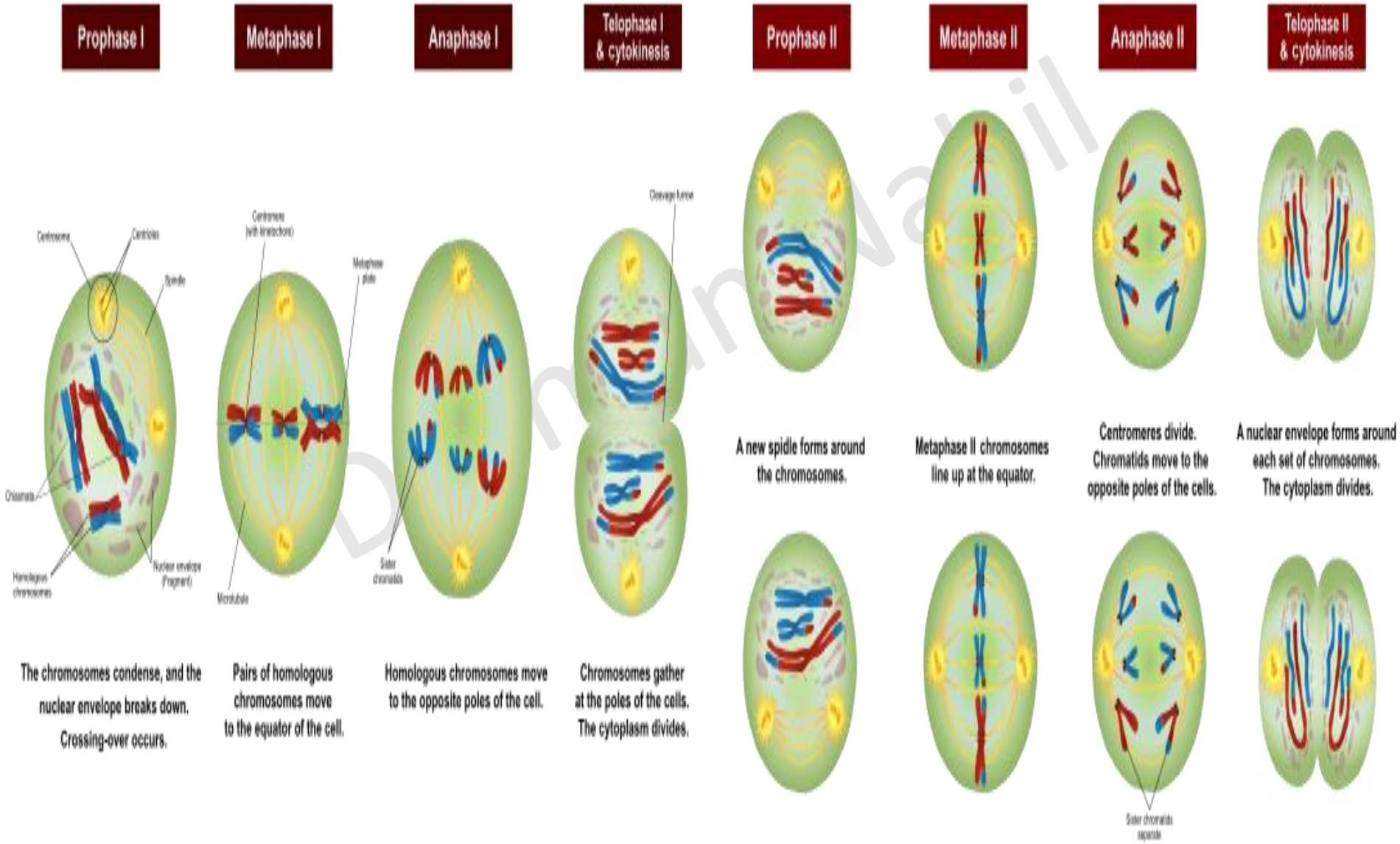
Types of chromatin	Heterochromatin	Euchromatin
1- LM	Dense basophilic clumps.	Lightly stained basophilic areas.
2- EM	Electron dense filaments or granules distributed in: 1- around nucleolus. 2- associated with inner nuclear membrane. 3- swimming in nuclear sap	Dispersed fine filaments or granules.
3- Function	Inactive part acts as a reserve (transformed into euchromatin when needed).	Active part (transcribed into RNA).
4- Site	Inactive cells.	Active cells e.g. dividing cells.



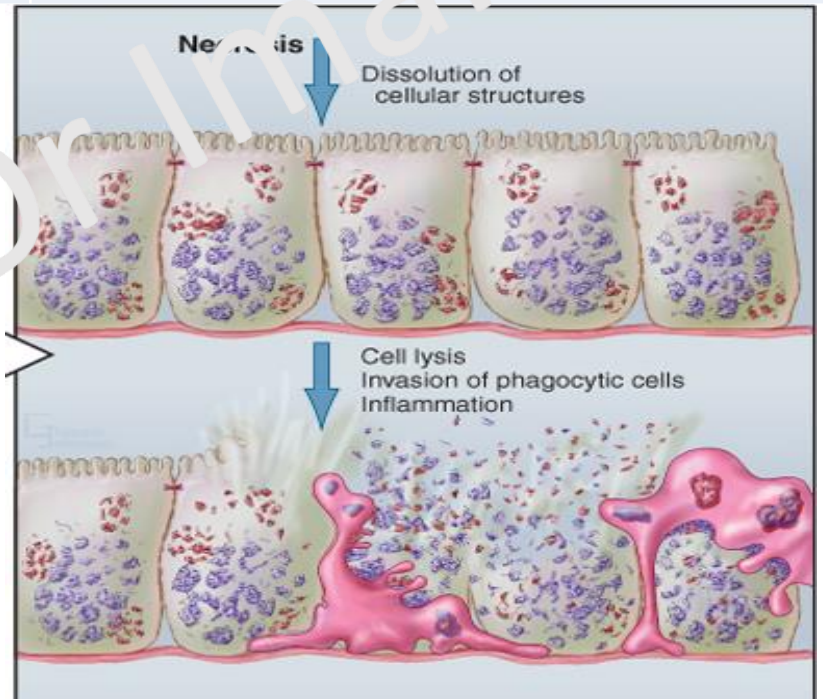
Types of cell division	Mitosis	Meiosis
1-Types of cells	Somatic cells	Germ cells of testis & ovaries
2- Number of division	Single division	2 successive divisions: Meiosis I & Meiosis II.
3- Interphase	Preceded by interphase with S phase	Meiosis I preceded by interphase with S phase, Meiosis II not preceded by S phase.
4- Prophase	No crossing over	Meiosis I: Crossing over occurs
5-Metaphase	46 d chromosomes arranged individually at the equatorial plane of the cells.	In Meiosis I :23 bivalent arranged at the equatorial plane of the cells.
6- Anaphase	Each chromosome divides at centromere into 2 chromatids	In Meiosis I: each chromosome of a bivalent moves apart.
7- Cells produced	Two daughter cells with diploid number of chromosomes (46 S) Daughter cells are genetically identical	Four daughter cells with haploid number of chromosomes (23 S) Daughter cells are genetically variable.
8- Functions	1- Growth and development of the organism. 2- Renewal and repair of cells.	Formation of gametes.

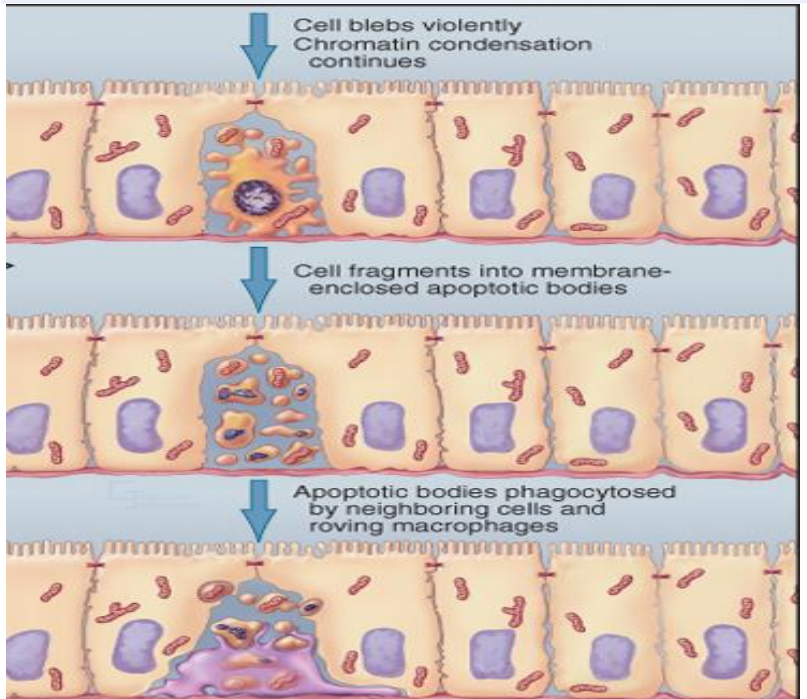
Meiosis	Meiosis I	Meiosis II
1- Preceded S phase	Present (the cell enter the prophase with 46 d chromosomes).	Absent (the cell enter the prophase with 23 d chromosomes).
2- Prophase	Pairing of homologous chromosomes result in 23 tetrad. Crossing over occurs between each tetrad .	No pairing No crossing over.
2- Metaphase	23 tetrad arranged at the equatorial plane of the cells.	23 d chromosomes arranged individually at the equatorial plane of the cells.
3- Anaphase	No division of the centromere. Each chromosome moves independently to the opposite pole of the cell.	Centromere splits so each chromatid moves independently to the opposite pole of the cell.
4- Telophase	Cytokinesis results in 2 daughter cells each with 23 d chromosomes.	Cytokinesis results in 4 daughter cells each with 23 S chromosomes.

	Meiosis I	Meiosis II



Types of cell death	Necrosis	Apoptosis
1- Type	Pathological.	Physiological.
2- Cell membrane	Damage with loss of its integrity.	Change of some characters without loss of its integrity.
3- Organelles	Broken down.	Intact.
4- Proteins	Denatured or coagulated.	Broken down of DNA with hypercondensation of chromatin.
5- Apoptotic bodies	Absent	Present
6- inflammation	Present	Absent



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