

NEET UG · BIOLOGY · CELL: THE UNIT OF LIFE

Functions of Cell Organelles

Location, structure and role of every cellular structure — organised for quick revision before tests.



44

STRUCTURES

7

TOPIC BLOCKS

NCERT

ALIGNED

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Tip: **highlighted words** are the key terms examiners love — revise them first.

01

CELL STRUCTURES

General & Universal Cell Structures

STRUCTURE	LOCATION / DESCRIPTION	FUNCTION / ROLE
01 Cell	The basic unit of life. It is the fundamental structural and functional unit of all living organisms.	Ensures independent existence and performance of the essential functions of life. The integrity of cellular organization is required for living phenomena (physiological and behavioral processes) to be demonstrated or observed.
02 Cytoplasm	A semi-fluid matrix that occupies the volume of the cell in both prokaryotic and eukaryotic cells.	It is the main arena of cellular activities in both plant and animal cells. Various chemical reactions occur here to keep the cell in the 'living state'.

STRUCTURE	LOCATION / DESCRIPTION	FUNCTION / ROLE
03 Plasma Membrane (Cell Membrane)	A thin outer layer (in animal cells). The delimiting structure of the cell. It is selectively permeable in nature.	Transport of molecules across the cell. Fluid membrane is important for functions like cell growth, formation of intercellular junctions, secretion, endocytosis, and cell division . Facilitates passive transport (like simple diffusion and osmosis) and active transport (energy-dependent, e.g., Na^+/K^+ Pump).
04 Ribosomes	Non-membrane bound organelles found in all cells (eukaryotic and prokaryotic). Composed of ribonucleic acid (RNA) and proteins. Found in the cytoplasm, within chloroplasts and mitochondria, and on rough ER.	They are the site of protein synthesis . Ribosomes on a polysome translate mRNA into proteins.

02

CELL STRUCTURES

Prokaryotic Cell Structures

STRUCTURE	DESCRIPTION	FUNCTION / ROLE
05 Nucleoid / Genetic Material	Basically naked, not enveloped by a nuclear membrane. Includes genomic DNA (single chromosome/circular DNA).	Contains the hereditary material.
06 Plasmids	Small circular DNA found outside the genomic DNA in many bacteria.	Confers certain unique phenotypic characters to bacteria, such as resistance to antibiotics . Not absolutely essential for survival of bacteria Used to monitor bacterial transformation with foreign DNA.
07 Cell Envelope	A chemically complex, tightly bound three-layered structure: outermost glycocalyx, followed by the cell wall, and then the plasma membrane.	The layers act together as a single protective unit .
08 Glycocalyx	Outermost layer of the cell envelope. Can be a loose sheath (slime layer) or thick and tough (capsule).	(Part of the protective unit).
09 Cell Wall	Surrounds the cell membrane (except in <i>Mycoplasma</i>).	Determines the shape of the cell . Provides strong structural support to prevent the bacterium from bursting or collapsing.
10 Mesosome	A specialized differentiated form of the cell membrane; essentially infoldings of the plasma membrane.	Helps in cell wall formation . Helps in DNA replication and distribution to daughter cells . Helps in respiration and secretion processes . Increases the surface area of the plasma membrane and its enzymatic content.

STRUCTURE	DESCRIPTION	FUNCTION / ROLE
11 Chromatophores	Membranous extensions into the cytoplasm found in some prokaryotes like cyanobacteria.	Contain pigments .
12 Flagella	Thin filamentous extensions from the cell wall. Composed of a filament, hook, and basal body.	Used for motility (if the bacteria are motile).
13 Pili	Elongated tubular structures made of a special protein.	Surface structures that do not play a role in motility .
14 Fimbriae	Small bristle-like fibers sprouting out of the cell.	Surface structures that do not play a role in motility . Known to help attach the bacteria to rocks in streams and also to the host tissues .
15 Inclusion Bodies	Reserve material stored in the cytoplasm (e.g., phosphate granules, glycogen granules, gas vacuoles). Not bound by a membrane system.	Store reserve material .

03

EUKARYOTIC CELL

The Endomembrane System

The endomembrane system includes the Endoplasmic Reticulum (ER), Golgi complex, lysosomes, and vacuoles, whose functions are coordinated.

STRUCTURE	LOCATION / DESCRIPTION	FUNCTION / ROLE
16 Endoplasmic Reticulum (ER)	A network or reticulum of tiny tubular structures scattered in the cytoplasm. Divides intracellular space into luminal and extra luminal compartments. Cisternae, tubules, vesicles	Helps in the transport of substances . Helps in vacuole formation.
17 Rough Endoplasmic Reticulum (RER)	ER bearing ribosomes on its outer surface. Frequently observed in cells actively involved in protein synthesis and secretion . Continuous with the outer membrane of the nucleus.	Helps in the synthesis of proteins and lipoproteins .
18 Smooth Endoplasmic Reticulum (SER)	ER lacking ribosomes.	The major site for synthesis of lipid . In animal cells, lipid-like steroidal hormones are synthesized here. Helps in muscle contraction by uptake and release of Ca^{2+} . Helps in the synthesis of glycogen .

STRUCTURE	LOCATION / DESCRIPTION	FUNCTION / ROLE
19 Golgi Apparatus (Golgi Complex)	Consists of flat, disc-shaped sacs or cisternae, arranged concentrically near the nucleus.	Primarily performs the function of packaging materials . Packages materials to be delivered either to intracellular targets or secreted outside the cell. Important site for the formation of glycoproteins and glycolipids .
20 Lysosomes	Membrane bound vesicular structures formed by the packaging process in the Golgi apparatus. Contains hydrolytic enzymes (lipases, proteases, carbohydrases).	Capable of digesting carbohydrates, proteins, lipids, and nucleic acids . Contains enzymes for digestion of all types of macromolecules.
21 Vacuoles	Membrane-bound space in the cytoplasm, bound by a single membrane called the tonoplast. Contains water, sap, excretory products, and other materials not useful for the cell.	In plants , the tonoplast facilitates the transport of ions and other materials against concentration gradients into the vacuole. In Amoeba , the contractile vacuole is important for osmoregulation and excretion . In protists , food vacuoles are formed by engulfing food particles.

04

EUKARYOTIC CELL

Energy Organelles

STRUCTURE	DESCRIPTION	FUNCTION / ROLE
22 Mitochondria	Double membrane-bound structure; inner membrane forms infoldings called cristae. Possesses its own single circular DNA, RNA, and 70S ribosomes.	The sites of aerobic respiration . Produce cellular energy in the form of ATP ("power houses" of the cell). Helps in oxidative phosphorylation and generation of ATP.
23 Plastids	Large organelles found in all plant cells and euglenoids that bear specific pigments. Possesses its own single circular DNA, RNA, and 70S ribosomes.	Impart specific colors to the plants. Store nutrients (Leucoplasts).
24 Chloroplasts	Green-colored plastids containing chlorophyll and carotenoid pigments. Double membrane bound.	Responsible for trapping light energy essential for photosynthesis .
25 Thylakoids / Grana & Stroma lamellae	Flattened membranous sacs inside the chloroplast stroma, often stacked into piles called grana. Chlorophyll pigments are present here.	The site of light reactions in photosynthesis.

STRUCTURE	DESCRIPTION	FUNCTION / ROLE
26 Stroma	The space limited by the inner membrane of the chloroplast. Contains enzymes required for the synthesis of carbohydrates and proteins.	The site of dark reactions in photosynthesis.
27 Chromoplasts	Contain fat-soluble carotenoid pigments (like carotene and xanthophylls).	Give parts of the plant a yellow, orange, or red color .
28 Leucoplasts	Colorless plastids of varied shapes and sizes.	Store nutrients (e.g., Amyloplasts store carbohydrates; Elaioplasts store fats; Aleuroplasts store proteins).

05

EUKARYOTIC CELL

Nucleus and Genetic Material

STRUCTURE	DESCRIPTION	FUNCTION / ROLE
29 Nucleus	A dense membrane-bound structure. Possesses an organized nucleus with a nuclear envelope.	Contains the chromosomes / genetic material (DNA). It controls the activities of organelles and plays a major role in heredity .
30 Nuclear Envelope	Consists of two parallel membranes surrounding the nucleus. Continuous with the ER.	Forms a barrier between the materials inside the nucleus and the cytoplasm.
31 Nuclear Pores	Minute interruptions in the nuclear envelope.	Passages through which movement of RNA and protein molecules takes place between the nucleus and the cytoplasm in both directions.
32 Chromatin	It is a packaged form of DNA. It is highly extended and elaborate nucleoprotein fibers in the interphase nucleus. Contains DNA, basic proteins (histones), non-histone proteins, and RNA.	Condenses to form structured chromosomes during cell division.
33 Centromere	Primary constriction on a chromosome.	Holds the two chromatids of a chromosome together.
34 Kinetochores	Disc-shaped structures present on the sides of the centromere.	Sites where spindle fibres attach to the chromosome during cell division.
35 Nucleolus	Spherical structure present in the nucleoplasm; not membrane bound.	Site for active ribosomal RNA synthesis .

Support and Locomotion Structures

STRUCTURE	DESCRIPTION	FUNCTION / ROLE
36 Cytoskeleton	Network of filamentous proteinaceous structures (microtubules, microfilaments, intermediate filaments) in the cytoplasm.	Involved in many functions such as mechanical support, motility, and maintenance of the shape of the cell.
37 Centrosome	Organelle (non-membrane bound) usually containing two centrioles.	Helps in cell division.
38 Centrioles	Two cylindrical structures in a centrosome, lying perpendicular to each other. Made of tubulin protein triplets.	Form the basal body of cilia or flagella. Form spindle fibres that give rise to the spindle apparatus during cell division in animal cells.
39 Cilia	Small, hair-like outgrowths of the cell membrane.	Work like oars, causing the movement of either the cell or the surrounding fluid.
40 Flagella	Comparatively longer, hair-like outgrowths of the cell membrane.	Responsible for cell movement.
41 Microbodies / Peroxisomes	Many membrane-bound minute vesicles.	Contain various enzymes. e.g., Peroxidase and Catalase which breakdown hydrogen peroxide to water and oxygen

Plant-Specific Structures

STRUCTURE	DESCRIPTION	FUNCTION / ROLE
42 Cell Wall	Non-living rigid structure outside the plasma membrane. Composed of cellulose, hemicellulose, pectins, and proteins (in plants).	Gives shape to the cell. Protects the cell from mechanical damage and infection. Helps in cell-to-cell interaction. Provides a barrier to undesirable macromolecules.
43 Middle Lamella	Layer mainly composed of calcium pectate.	Holds or glues the different neighboring cells together.
44 Plasmodesmata	Structures that traverse the cell wall and middle lamella.	Connect the cytoplasm of neighboring cells.

QUICK RECALL

Cover the right side & test yourself

Site of protein synthesis	Ribosomes	Powerhouse of the cell — produces ATP	Mitochondria
Packaging of materials; forms glycoproteins & glycolipids	Golgi apparatus	Major site of lipid & steroid hormone synthesis	Smooth ER
Osmoregulation & excretion in <i>Amoeba</i>	Contractile vacuole	Site of active rRNA synthesis	Nucleolus
Antibiotic resistance in bacteria	Plasmids	Attach bacteria to rocks & host tissues	Fimbriae
Site of light reactions	Thylakoids (grana)	Site of dark reactions	Stroma
Glues neighbouring plant cells together	Middle lamella	Basal body of cilia/flagella; spindle fibres	Centrioles

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