Chapter

1

Cell: Structures and their Functions

KEY-TERMS

- **Cells:** Cells are the basic unit of structure in all organisms. It is the smallest structural and functional unit of an organism, which is typically microscopic and consists of cytoplasm and a nucleus enclosed in a membrane.
- **Cell Wall:** A rigid, but often flexible, layer containing cellulose or chitin, pectin, and other polymers. The cell wall is the outermost structures of plant, algal, fungal, and some prokaryotic cells.
- **Centriole:** A tubular structures that is made of protein and found only in animal cells. It is involved in cell division and the formation of flagella and cilia (types of points that assist cells in what they do).
- **Chloroplast:** The organelle in plant cells, and a few other eukaryotic cells, that contains chlorophyll, the magical green pigment, and carries out the process of photosynthesis, the conversion of sunlight into food.
- **Cholesterol:** A carbon-based steroid molecule that provides permeability and fluidity to plasma membranes. Cholesterol gets a bad rap for clogging arteries and causing heart attacks when present in the body in excessive amounts.
- **Chromosome:** A single piece of wound (as in, "twisted," not "injury") DNA bound to other "stuff" like proteins and nucleotides.
- **Chromatin:** A condensed package of DNA and proteins in the nucleus of a cell.
- **Cilium (plural cilia):** A projection of a cell membrane sticking out from the main cell body. Cilia are used for locomotion (choo choo) in some unicellular, aka one-celled, organisms, and for movement of matter past a group of cells in some multicellular, more than one-celled organisms. For example, cilia move the mucus and debris past the mucosal cells lining the tracheae in some animals.
- **Cytoplasm:** The cytosol (fluid inside cells), organelles (except the nucleus), and other particles enclosed within the cell membrane. The cytoplasm is the site of most cellular activities, including glycolysis, aka the production of energy from carbohydrates, and cell division, or the way cells reproduce.
- **Cytosis:** The process by which cells bring in or release very large particles and quantities of fluid. Exocytosis is the general term for cell release, endocytosis is the general term for cell consumption, and pinocytosis and phagocytosis are specific types of endocytosis. Pinocytosis refers to the cellular uptake of fluid, or "cell drinking," while phagocytosis refers to the cellular uptake of solid matter, or "cell eating." Not like cookie eating.
- **Cytoskeleton:** The complex structure of protein filaments within the cytosol (fluid inside cells) that maintains cell shape and structure, controls cellular locomotion and cytosis, provides scaffolding for intracellular transport, and controls cell division. A cytoskeleton is found in all types of both eukaryotic and prokaryotic cells.
- **Cytosol:** The fluid component of the cytoplasm (collective name for the stuff within the boundaries of the cell membrane) composed of cytoskeleton filaments, dissolved molecules, and water. The cytosol is the part of the cytoplasm between the cell membrane and organelle membranes. A membrane has a thin encasing layer.
- **Endosymbiosis:** The condition of living within the body or cells of another organism. Sounds weird, and it is. There is evidence that millions of years ago, the ancestors of mitochondria and chloroplasts, two organelles (mini organs) were actually prokaryotic organisms that entered into endosymbiotic relationships with eukaryotic cells. We know; that is some wild and crazy talk right there.

- **Enzymes:** A protein that catalyzes, or increases the rate of, a chemical reaction in a cell. Most enzyme catalyzed reactions in the cell take place within the cytosol (fluid inside cells), but many others take place within the nucleus and within certain organelles (mini organs) like lysosomes, mitochondria, and chloroplasts (the green organelle in plants).
- **Eukaryote :** An organism whose cells contain a membrane-bound nucleus. Many eukaryotic cells also possess other membrane-bound organelles. All eukaryotes are more closely related to each other than they are to prokaryotes. Apples and oranges you might say, except apples and oranges are both eukaryotes so…that analogy doesn't work. Scratch that.
- **Flagellum :** A slender thread-like structure, especially a microscopic whip-like appendage which enables many protozoa, bacteria, spermatozoa, etc. to swim.
- **Genome:** A genome is an organism's complete set of genetic instructions. Each genome contains all of the information needed to build that organism and allow it to grow and develop.
- **Golgi Body:** An organelle ("mini organ") in eukaryotic cells containing between three and seven flattened membrane disks called cisternae. The Golgi body packages and processes proteins and lipids, and is also called the "Golgi apparatus." Stack of pancakes, anyone?
- **Histone:** Large protein complexes that control the messages sent from the DNA to the rest of the cell.
- **Hydrophilic:** The physical property of being attracted to water, or "water-loving." Phosphate ions (PO_4^{3-}) and other ions are notoriously hydrophilic. They have an unhealthy obsession with water.
- **Hydrophobic:** The physical property of being repelled by water, or "water-fearing." Lipids (fatty fat fats) are notoriously hydrophobic. Living in fear is no fun, so hydrophobic things like to cling to each other like white on rice when water is nearby.
- **Lysosome:** A spherical, membrane-bound organelle ("mini organ") in eukaryotic cells (membrane-bound-nucleus-containing) that contains enzymes (catalysts) and other proteins that digest, or break down, substances that have been taken into a cell by phagocytosis (swallowing them up).
- **Mitochondrion (plural mitochondria) :** A membrane-bound organelle ("mini organ") in eukaryotic cells, aka those cells that contain a membrane-bound nucleus. Mitochondria have their own inner and outer membranes that provide the structure needed to make large quantities of usable energy (in the form of ATP) from lipids, sugars, and proteins in a process known as cellular respiration. The mitochondrion is the cell's powerhouse.
- **Nucleus (plural nuclei):** The membrane-bound organelle ("mini organ") in eukaryotic cells, aka those cells that contain a membrane-bound nucleus, that is the "control center" of the cell. The nucleus houses the genetic instructions necessary to synthesize proteins and other molecules needed for cell survival, growth, and reproduction. The nucleus also contains the nucleolus where ribosomal RNA (rRNA) is transcribed and assembled. Think of the nucleus as the control center in some far away space station. You may have noticed that the word nucleus gets thrown around a lot. Just don't confuse the nucleus of an atom with the nucleus of a cell—they are not the same thing! The general name given to the membrane-bound structures within a eukaryotic cell (the cells that have nuclei) that perform specific functions necessary for cell survival, growth, or reproduction. Examples include Golgi bodies, lysosomes, mitochondria, chloroplasts, endoplasmic reticulum, vacuoles, and vesicles.
- **Phospholipid:** Phospholipids are a class of lipids that are a major component of all cell membranes. They can form lipid bilayers because of their amphiphilic characteristic. The structure of the phospholipid molecule generally consists of two hydrophobic fatty acid "tails" and a hydrophilic "head" consisting of a phosphate group. The lipid "tail" is usually a diglyceride, or two fatty acid chains and a glycerol, and is hydrophobic ("water-fearing"). The phosphate "head" group has a chemical structure of $–H_2PO_4R$, where R is a functional group, and is hydrophilic ("water-loving"). In the plasma membrane (see next definition), phospholipids form a bilayer with the lipid "tails" facing each other on the inside of the bilayer and the phosphate "heads" facing outward, toward both the outside and inside of the cell.
- **Plasma Membrane:** A phospholipid bilayer separating the interior of a cell from the surrounding environment. The plasma membrane is composed primarily of phospholipids, protein complexes, and cholesterol molecules. The membrane does lots of stuff, including protecting the cell, transporting materials into and out of the cell, and helping the cell communicate to other cells.

- **Prokaryote:** An organism whose cells lack nuclei (a control center) and membrane-bound organelles ("mini organs"). Prokaryotes are generally single-celled. One is the loneliest number.
- **Protein:** A chain, or chains, of amino acids specifically folded to take on a certain shape, one that determines the protein's functions. All enzymes are proteins, but not all proteins are enzymes.
- **Ribosome:** A complex structure is made of proteins and ribosomal RNA, or rRNA. Ribosomes are found in all cells, both prokaryotic and eukaryotic. Together with messenger RNA (mRNA) and transfer RNA (tRNA), ribosomes synthesize proteins from amino acids (the building blocks of proteins). Ribosomes are not generally considered organelles because they are not membrane bound.
- **Vacuole:** A large, membrane-bound organelle ("mini organ") found in most plant and fungal cells, as well as some animal and bacterial cells. The vacuole's job varies with cell type, but in many cases, the vacuole is involved in water regulation, waste removal, and pH balance within the cell. It is sometimes called the central vacuole. In appearance, the vacuole of the cell looks like a round blob.
- **Vesicle:** A small, sac-like organelle ("mini organ") involved in the transport and storage of cellular substances, especially proteins marked for secretion from the cell, aka cell exit. Golgi bodies form the vesicles.

INTRODUCTION

Cells, the smallest structures capable of maintaining life and reproducing, compose all living things, from single-celled plants to multi billion-celled animals. The human body, which is made up of numerous cells, begins as a single, newly fertilized cell. Almost all human cells are microscopic in size. To give you an idea how small a cell is, one average-sized adult body, according to one estimate, consists of 100 trillion cells!

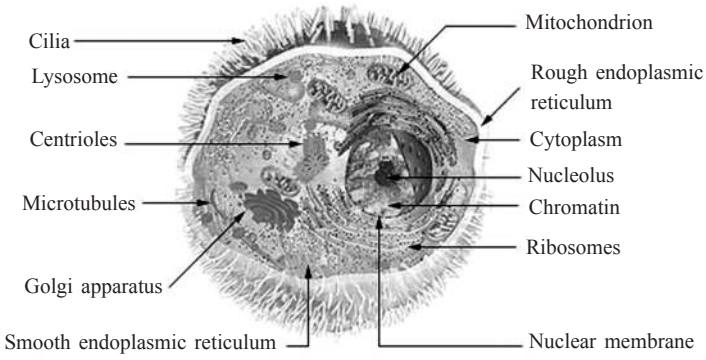

Fig. 1: Cell structure.

There are many different types, sizes, and shapes of cells in the body. For descriptive purposes, the concept of a "generalized cell" is introduced. It includes features from all cell types.

A cell consists of three parts: the cell membrane, the nucleus, and, between the two, the cytoplasm. Within the cytoplasm lie intricate arrangements of fine fibers and hundreds or even thousands of miniscule but distinct structures called **organelles.**

CELL: THE UNIT OF LIFE

All organisms are made of cells. Cells vary in their shape, size as well as functions. Based on the presence or absence of a membrane bound nucleus and other organelles, organisms are classified as Eukaryotes or Prokaryotes.

Prokaryotes includes Bacteria, Blue Green Algae, Mycoplasma and PPLO (Pleuro Pneumonia Like Organisms). These cells are small and multiply at a faster rate.

Eukaryotes includes Protists, Plants, Fungi and Animals. They have cell organelles separated by a membrane. They have well developed nucleus separated by a **nuclear membrane.**

A typical Eukaryotic cell consists of a cell membrane, Nucleus, Mitochondria, Endoplasmic Reticulum, Golgi Body, Chloroplast in Plant Cells, etc.

Plant cells have a cell wall outside the cell membrane. These cell organelles are different from each other in structure and function.

In Eukaryotes (Higher Organisms), cell is surrounded by a membrane known as **Plasma Membrane** or **Cell Membrane.** Plasma membrane is made up of lipids and protein. Plant cell is surrounded by **cell wall**.

Cell wall is made up of Polysaccharide known as Cellulose. Cellulose provides strength and rigidity to the cell.

Cell Membrane

Every cell in the body is enclosed by a cell (Plasma) membrane. The cell membrane separates the material outside the cell, extracellular, from the material inside the cell, intracellular. It maintains the integrity of a cell and controls passage of materials into and out of the cell.

All materials within a cell must have access to the cell membrane (the cell's boundary) for the needed exchange.

The cell membrane is a double layer of phospholipid molecules. Proteins in the cell membrane provide structural support, form channels for passage of materials, act as receptor sites, function as carrier molecules, and provide identification markers.

Nucleus and Nucleolus

The nucleus, formed by a nuclear membrane around a fluid nucleoplasm, is the control center of the cell. Threads of chromatin in the nucleus contain deoxyribonucleic acid (DNA), the genetic material of the cell.

The nucleolus is a dense region of ribonucleic acid (RNA) in the nucleus and is the site of ribosome formation. The nucleus determines how the cell will function, as well as the basic structure of that cell.

Cytoplasm

The cytoplasm is the gel-like fluid inside the cell. It is the medium for chemical reaction. It provides a platform upon which other organelles can operate within the cell. All of the functions for cell expansion, growth and replication are carried out in the cytoplasm of a cell. Within the cytoplasm, materials move by diffusion, a physical process that can work only for short distances.

Cytoplasmic Organelles

Cytoplasmic organelles are "little organs" that are suspended in the cytoplasm of the cell. Each type of organelle has a definite structure and a specific role in the function of the cell. Examples of cytoplasmic organelles are mitochondrion, ribosomes, endoplasmic reticulum, golgi apparatus, and lysosomes.

STRUCTURE OF THE CELL

A typical cell structure is shown in figure 1. Ribosomes are cell organelles involve in protein synthesis. They are composed of large and small subunits. A network of tubules spread in a cytoplasm is known as Endoplasmic Reticulum or ER.

There are two types of ER— Rough ER and Smooth ER. Rough ER is covered by ribosomes whereas smooth ER do not contain ribosomes. Rough ER is involved in protein synthesis and smooth ER is involved in fatty acid synthesis and detoxification. Golgi Body is involved in secretion process, that is, it is involved in packaging of materials that are needed to be transported.

Lysosomes help in digestion of lipids, proteins and carbohydrates. Mitochondria is a double membrane structure-the outer membrane and inner membrane. The inner membrane is folded to form a structure known as **Cristae**. It is a site for ATP synthesis.

CELL FUNCTION

The structural and functional characteristics of different types of cells are determined by the nature of the proteins present. Cells of various types have different functions because cell structure and functions are closely related. It is apparent that a cell that is very thin, is not well suited for a protective function.

Bone cells do not have an appropriate structure for nerve impulse conduction. Just as there are many cell types, there are varied cell functions. The generalized cell functions include movement of substances across the cell membrane, cell division to make new cells, and protein synthesis.

Movement of Substances Across the Cell Membrane

The survival of the cell depends on maintaining the difference between extracellular and intracellular material. Mechanisms of movement across the cell membrane include simple diffusion, osmosis, filtration, active transport, endocytosis, and exocytosis.

Simple diffusion is the movement of particles (solutes) from a region of higher solute concentration to a region of lower solute concentration.

Osmosis is the diffusion of solvent or water molecules through a selectively permeable membrane. Filtration utilizes pressure to push substances through a membrane. Active transport moves substances against a concentration gradient from a region of lower concentration to a region of higher concentration. It requires a carrier molecule and uses energy.

Endocytosis refers to the formation of vesicles to transfer particles and droplets from outside to inside the cell. Secretory vesicles are moved from the inside to the outside of the cell by exocytosis.

Cell Division

Cell division is the process by which new cells are formed for growth, repair, and replacement in the body. This process includes division of the nuclear material and division of the cytoplasm.

All cells in the body (somatic cells), except those that give rise to the eggs and sperm (gametes), reproduce by mitosis. Egg and sperm cells are produced by a special type of nuclear division called meiosis in which the number of chromosomes is halved. Division of the cytoplasm is called **cytokinesis.**

The sequence of events that occur during cell growth and cell divisions are known as **Cell Cycle.** It is divided into two phases:

- Interphase
- M phase.

Interphase is the period between the cell divisions. It is the resting phase. It comprises of:

- G1 phase is the phase in which a cell prepares for DNA replication.

- S phase is the phase where DNA replicates.
- G2 phase is the phase when the cell prepares itself for M phase or mitosis.

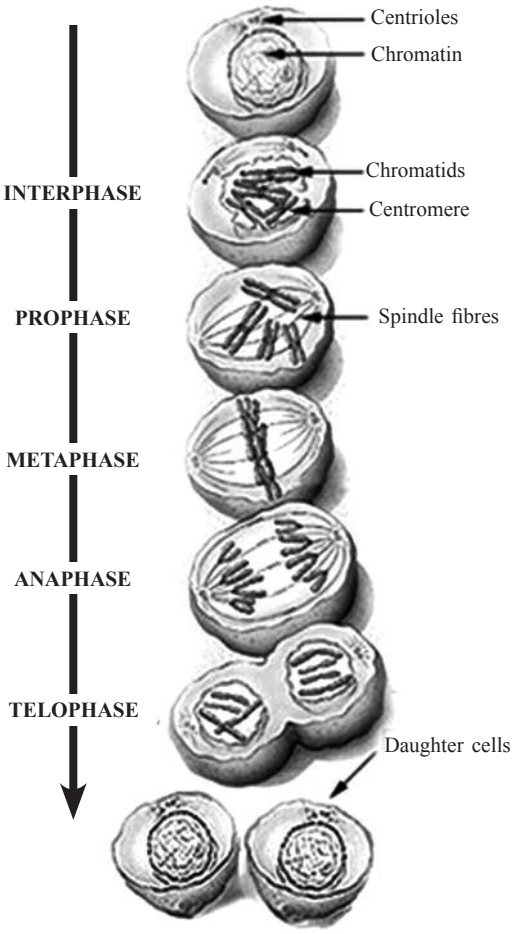

Fig. 2: Mitosis.

- M phase or the Mitotic phase is the process of formation of two daughter cells from the parent cell. The most important characteristics of M phase is, the DNA content remains same. It is also divided into different phases—Prophase, Metaphase, Anaphase, Telophase and Lastly Cytokinesis in which cell divides.
- Meiosis also known as Reductional division is responsible for the formation of gametes required for reproduction. It reduces the DNA content to half as compared to the parent cell.
- Somatic cells reproduce by mitosis, which results in two cells identical to the one parent cell. Interphase is the period between successive cell divisions. It is the longest part of the cell cycle.
- The successive stages of mitosis are prophase, metaphase, anaphase, and telophase. Cytokinesis, division of the cytoplasm, occurs during telophase.
- Meiosis is a special type of cell division that occurs in the production of the gametes, or eggs and sperm. These cells have only 23 chromosomes, one-half the number found in somatic cells, so that when fertilization takes place the resulting cell will again have 46 chromosomes, 23 from the egg and 23 from the sperm.

Comparison Chart

Eukaryotic Cell	Prokaryotic Cell	
Nucleus	Present	Absent
Number of chromosomes	More than one	One—but not true chromosome: Plasmids
Cell Type	Usually multicellular	Usually unicellular (some cyanobacteria may be multicellular)
True Membrane bound Nucleus	Present	Absent
Example	Animals and Plants	Bacteria and Archaea
Genetic Recombination	Meiosis and fusion of gametes	Partial, undirectional transfers DNA
Lysosomes and peroxisomes	Present	Absent
Microtubules	Present	Absent or rare
Endoplasmic reticulum	Present	Absent
Mitochondria	Present	Absent
Cytoskeleton	Present	May be absent
DNA wrapping on proteins.	Eukaryotes wrap their DNA around proteins called histones.	Multiple proteins act together to fold and condense prokaryotic DNA. Folded DNA is then organized into a variety of conformations that are supercoiled and wound around tetramers of the HU protein.
Ribosomes	larger	smaller
Vesicles	Present	Present
Golgi apparatus	Present	Absent
Chloroplasts	Present (in plants)	Absent; chlorophyll scattered in the cytoplasm
Flagella	Microscopic in size; membrane bound; usually arranged as nine doublets surrounding two singlets	Submicroscopic in size, composed of only one fiber

Permeability of Nuclear Membrane	Selective	not present
Plasma membrane with steroid	Yes	Usually no
Cell wall	Only in plant cells and fungi (chemically simpler)	Usually chemically complexed
Vacuoles	Present	Present
Cell size	10-100 μm	1-10 μm

Difference between Meosis and Mitosis

Meiosis

- It occurs in sex organs during gamete formation.
- Four daughter cells are formed
- Parent cell has diploid number of chromosomes and daughter cells have haploid number of chromosomes
- Daughter cells are not identical to parent cell

Mitosis

- It occurs in somatic cells during growth, repair and replacement of cells
- Two daughter cells are formed.
- Both parent and daughter cells have diploid number of chromosomes
- Daughter cells are identical to parent cell

DNA Replication and Protein Synthesis

Proteins that are synthesized in the cytoplasm function as structural materials, enzymes that regulate chemical reactions, hormones, and other vital substances. DNA in the nucleus directs protein synthesis in the cytoplasm. A gene is the portion of a DNA molecule that controls the synthesis of one specific protein molecule. Messenger RNA carries the genetic information from the DNA in the nucleus to the sites of protein synthesis in the cytoplasm.

Prokaryotes and Eukaryotes

Prokaryotes are organisms without a cell nucleus (karyon), or any other membrane-bound organelles. Most are unicellular, but some prokaryotes are multicellular.

Eukaryotes are organisms whose cells are organized into complex structures by internal membranes and a cytoskeleton. The most characteristic membrane bound structure is the nucleus. This feature gives them their name, (also spelled "eucaryote,") which comes from the Greek, meaning good/true, and, meaning nut, referring to the nucleus. Animals, plants, fungi, and protists are eukaryotes.

Differences Between Eukaryotic and Prokaryotic Cells

The difference between the structure of prokaryotes and eukaryotes is so great that it is considered to be the most important distinction among groups of organisms.

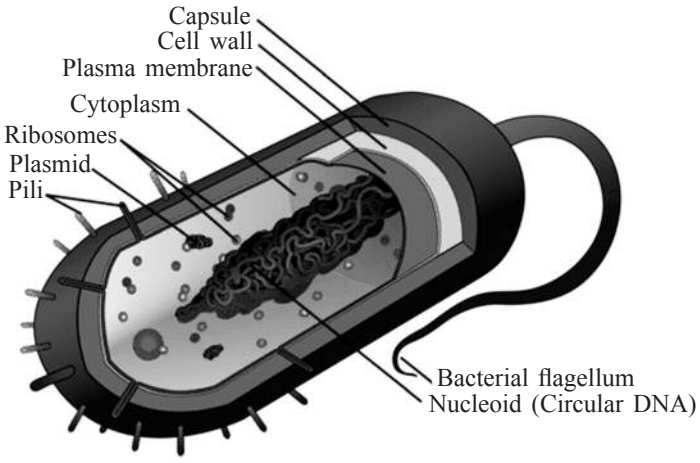

Fig. 3: Structure and contents of a typical Gram-positive bacterium cell (a prokaryotic cell).

- The most fundamental difference is that eukaryotes do have "true" nuclei containing their DNA, whereas the genetic material in prokaryotes is not membrane-bound.
- In eukaryotes, the mitochondria and chloroplasts perform various metabolic processes and are believed to have been derived from endosymbiotic bacteria. In prokaryotes similar processes occur across the cell membrane; endosymbionts are extremely rare.
- The cell walls of prokaryotes are generally formed of a different molecule (peptidoglycan) to those of eukaryotes (many eukaryotes do not have a cell wall at all).
- Prokaryotes are usually much smaller than eukaryotic cells.
- Prokaryotes also differ from eukaryotes in that they contain only a single loop of stable chromosomal DNA stored in an area named the nucleoid, while eukaryote DNA is found on tightly bound and organised chromosomes. Although some eukaryotes have satellite DNA structures called plasmids, these are generally regarded as a prokaryote feature and many important genes in prokaryotes are stored on plasmids.
- Prokaryotes have a larger surface area to volume ratio giving them a higher metabolic rate, a higher growth rate

and consequently a shorter generation time compared to Eukaryotes.

- **Genes**
  - Prokaryotes also differ from eukaryotes in the structure, packing, density, and arrangement of their genes on the chromosome. Prokaryotes have incredibly compact genomes compared to eukaryotes, mostly because prokaryote genes lack introns and large non-coding regions between each gene.
  - Whereas nearly 95% of the human genome does not code for proteins or RNA or includes a gene promoter, nearly all of the prokaryote genome codes or controls something.
  - Prokaryote genes are also expressed in groups, known as operons, instead of individually, as in eukaryotes.
  - In a prokaryote cell, all genes in an operon(three in the case of the famous lac operon) are transcribed on the same piece of RNA and then made into separate proteins, whereas if these genes were native to eukaryotes, they each would have their own promoter and be transcribed on their own strand of mRNA. This lesser degree of control over gene expression contributes to the simplicity of the prokaryotes as compared to the eukaryotes.

Distinction

The distinction between prokaryotes and eukaryotes is considered to be the most important distinction among groups of organisms. Eukaryotic cells contain membrane-bound organelles, such as the nucleus, while prokaryotic cells do not. Differences in cellular structure of prokaryotes and eukaryotes include the presence of mitochondria and chloroplasts, the cell wall, and the structure of chromosomal DNA.

Prokaryotes were the only form of life on Earth for millions of years until more complicated eukaryotic cells came into being through the process of evolution.

SUM-UP

- **Prokaryotic and Eukaryotic Cells**
  - All cells are broadly classified into prokaryotic cells and eukaryotic cells, according to whether their genetic materials are enclosed by a nuclear envelope or not.
  - Prokaryotic cells are the most primitive cells. They do not contain a definite nucleus. The chromatin bodies remain scattered inside the cytoplasm. Such a type of nucleus without a nuclear membrane is called a nucleoid. For example, bacteria, cyanobacteria (blue green algae) etc
  - All cells share some common characteristics that make them living things. All organisms are composed of cells, the basic fundamental unit of life. They contain DNA as a heritable genetic material, and they can reproduce. They transcribe DNA into RNA and translate RNA into proteins on ribosomes. They can also regulate transport across a cell membrane and require chemical energy for some cellular processes.
  - Organelles are the biggest difference between bacteria and cells that make up the human body.
- **Organelles**
  - The number one biggest difference between the bacteria in your body and the cells making up your body are these tiny cellular components called organelles. Organelles are simply membrane-bound compartments within a cell, such as the nucleus, mitochondria, chloroplasts, Golgi, and endoplasmic reticulum.
  - Your cells are eukaryotic. Eukaryotic cells contain membrane-bound organelles, including a nucleus. Eukaryotes can be single-celled or multi-celled, such as you, me, plants, fungi, and insects.
  - Bacteria are an example of prokaryotes. Prokaryotic cells do not contain a nucleus or any other membrane-bound organelle. Prokaryotes include two groups: bacteria and another group called *archaea.*
  - Having organelles is a big deal for a cell. A bacteria cell gets along just fine without organelles, but bacteria are tiny. That's why we're able to have so many of them in our body without really noticing them. Our cells, though - they're still small to the naked eye, but they're huge in comparison to bacteria. Our eukaryotic cells are bigger in size, with much more DNA. More DNA means more transcription, and more transcription means more translation, and more translation means more proteins. Bigger cells create the need for organelles.
  - Organelles are an efficient way to organize everything that's going on in the cell—to compartmentalize cellular functions. That's exactly what a eukaryotic cell is doing-separating cellular processes and organizing its space.

- Different Features of Prokaryotes
  - These are organisms made up of cells that lack a cell nucleus or any membrane-encased organelles.
  - It has no nucleus.
  - It has a circular loop.
  - It is usually present; chemically complex in nature. It does not contain protein in its DNA.
  - It contains small ribosomes.
  - It has a huge variety of metabolic pathways.
  - It consists of two protein building blocks.
  - It performs functions of golgi-bodies and mitochondria, and also help in separation of chromosomes.
- Nucleoid
  - It is the central region in a prokaryotic cell. It is as a bacterium, that contains the chromosomes and that has no surrounding membrane. If you have a lot of shoes and a walk-in closet, the nucleus would obviously be the shoe rack—a structure to hold and organize all this important material. Having a nucleus or not is the biggest difference between eukaryotes and prokaryotes. Remember that your eukaryotic cells have linear DNA.
  - Prokaryotic cells have a smaller, circular DNA genome. With a smaller size and a smaller genome, prokaryotes don't really need a nucleus. Their DNA is housed in a nucleoid, which isn't really a structure at all. There are no membranes around it, so it's not a separated compartment. The nucleoid is simply the area where DNA exists. This is the defining difference between prokaryotic and eukaryotic cells. For example, DNA replication and transcription take place in this nucleoid area of the cytoplasm. While translation is still carried out on ribosomes, these are not membrane-bound organelles, and all ribosomes in a bacterium float free in the cytoplasm. There is no endoplasmic reticulum.
  - Prokaryotic and eukaryotic ribosomes are both made of rRNA and proteins, but the subunits are going to be different sizes. In addition, a group of bacteria can perform photosynthesis like plants.

MULTIPLE CHOICE QUESTIONS

1. Prokaryotic cell does not have
(a) Mitochondria (b) 80S ribsome
(c) Golgi apparatus (d) All of the above

2. Which of the following is not a part of prokaryotic cell?
(a) Plasma membrane bound enzymes
(b) Nucleoid
(c) Nucleolus
(d) Ribosome

3. In eukaryotic cells, cellular organelles are embedded in
(a) Protoplasm (b) Nucleoplasm
(c) Cytoplasm (d) Cytosol

4. The history of cell biology began with the publication of
(a) Cell doctrine (b) Origin of species
(c) Micographia (d) Origin of life

5. A cell without intracellular compartmentalisation is know as
(a) Pokaryotes (b) Eukarycte
(c) Viruses (d) WBC's

6. The prokaryotic cells are characterised by
(a) A distinct nucleus
(b) Distinct chromosome
(c) Absence of chromatin network
(d) Absence of nuclear membrane

7. The term 'cell' was given by
(a) Robert Browon (b) Robert Hook
(c) Leuwenchock (d) Schleiden

8. In eukaryotic cell, the rigion between nucleus and plasma membrane is called
(a) Lumen (b) Cytoplasm
(c) Karyoplasm (d) Nucleoplasm

9. Which of the following organelle is present in both prokaryotes and eukaryotes
(a) Mitochondria (b) Ribosome
(c) Nucleoli (d) Plastids

10. The smallest cell of human body is
(a) WBC (b) RBC
(c) Nerve cell (d) Egg cell

11. Large cells are
(a) Metabolically more active
(b) With low surface to volume ratio
(c) More efficient
(d) Without compartmentalisation

12. Which one of the following is a prokaryotic cell
(a) Nostoc (b) Anabaena
(c) Bacteria (d) All of the above

13. For the maintenance of organised structures and functions, the living cell require
(a) Constant supply of water
(b) Constant supply of protein
(c) Constant supply of energy
(d) Constant supply of mineral

14. DNA with histonic proeins is the genetic material in
(a) Plastid (b) Mitochondria
(c) E. coli (d) Eukaryotic cell

15. The substitute of mitochondria in bacteria is
(a) Ribosome
(b) Nucleoid
(c) Golgi bodies
(d) Cell membrane and mesosome

16. In addition to the cellulose, cell wall of bacteria contains
(a) Glycoprotiens (b) Muramic acid
(c) Oligosaccharide (d) Lipoprotiens

17. Which is the only organelle present in prokaryotes
(a) Mitochondria (b) Ribosomes
(c) Golgi complex (d) Centriole

18. Cell division on prokaryotes takes place by
(a) Mitosis (b) Meiosis
(c) Binary fission (d) All of the above

19. Nuclear material with cover is found in
(a) Mycoplasma (b) Bacteria and fungi only
(c) Plant cell (d) Bacteria and blue green algae

20. The division of the animal kingdom into prokaryotes and eukaryotes is based on the characters of
(a) Nucleus only (b) Chromosomes only
(c) Cell organelle only (d) All above

21. The word prokaryote means, a cell
(a) With may nucleus (b) With one nucleus
(c) With diffused nucleus (d) Without chloroplast

22. Largest physical and chemical molecules for cells are
(a) Carbohydrates (b) Lipids
(c) Protiens (d) Nucleic acid

23. Histonic proteins are absent is DNA OF
(a) Mitochondria (b) Plastid
(c) Bacteria (d) All of the above

24. Both cell eating and drinking is lacking in
(a) Bacteria (b) Blue green algae
(c) Amoeba (d) Both (a) and (b)

25. Cells of all organisms have close similarity in their
(a) Molecular organization (b) Structure
(c) Biological activities (d) All of the above

26. Nucleus and most of the cell organelles are present in
(a) Bacteria (b) Blue green algae
(c) Mammalian RBC (d) aMOEBA

27. Flagella is bacteria have
(a) 9 + 0 arrangement of microtubules
(b) 9 + 2 arrangement of microtubules
(c) Single unit of flagelling proteins
(d) Tubulin protein

28. Which organelle helps in division of bacteria
(a) Ribosome (b) Mitochondria
(c) Centriole (d) Mesosome

29. Basic unit of life is
(a) Cell (b) Tissue
(c) Organ (d) Mesosome

30. The smallest living cells are
(a) Mycoplasma (b) Blue green algae
(c) RBC (d) Nerve cell

31. The continutiy of eytoplasm from one cell to other cell is maintained by
(a) Plasmodesmata (b) Tracheids
(c) Cell wall (d) Sieve tube

32. Match the following

Column I	Column II
A. Smallest cell	(I) PPLO
B. Eukaryotic cell	(II) Amoeba
C. Prokaryotic cell	(III) Blue green algae

Codes:

	A	B	C
(a)	III	II	I
(b)	III	I	II
(c)	I	II	III
(d)	II	I	III

33. Figures of cork cells observed by Robert Hook were published in
(a) Genera Plantarum (b) Species plantinum
(c) Origin of species (d) Micrographia

34. Smaller cell is
(a) Less active metabolically
(b) With smaller nucelues
(c) With larger nuclues
(d) More active metabolicality

35. Prokaryotic nucleoids has
(a) Mitotic apparatus (b) Chromosomes
(c) Nucleosome (d) Histones

36. Minute structures on bacteria cell are called
(a) Hair (b) Cilia
(c) Flagella (d) Pili

37. 80% of the cell is contributed by
(a) Minerals (b) Water
(c) Proteins (d) Carbohydrates

38. In eukaryotic cell, the amount of basic protein is
(a) Equal to the amount of DNA
(b) Less than the amount of DNA
(c) Equal to the amount of RNA
(d) Varies from organism to organism

39. Which is true for animal cell
(a) They have definite structure
(b) They have an independent structure
(c) The lack cell wall
(d) They can never have chloroplast

40. Chemical nature of carrier molecules faciliting transport across plasma membrane is
(a) Starchy (b) Surgary
(c) Proteinaceous (d) Fatty acid

41. The main function of the cell membrane is to
(a) Regulate the flow of material into and out side the cell
(b) Maintain the cell shape and size
(c) Control all cellular activities
(d) Store cell material

42. A prokaryotic cell does not process
(a) Nucleular membrane (b) Plasma membrane
(c) Cell wall (d) Both (a) and (b)

43. Ion carriers are located in
(a) Cell wall (b) Cell membrane
(c) Intercellular spaces (d) Nucleus

44. The differentiation of Fluid mosaic model from Robertson's model is in
(a) Lipid molecule arrangement
(b) Protein molecule arrangement
(c) Number of lipid layers
(d) All of the above

45. The plasma membrane of Mycoplasma is rich in
(a) Cellulose (b) Myosin
(c) Mycosin (d) Glycogen

46. Gel part of plasma membrane is
(a) Ectoplasm (b) Endoplasm
(c) Plasmalemma (d) Both (a) and (b)

47. Correct squence of protein (P) and lipid (L) in cell membrane as per lamellar model is
(a) L-P-L-P (b) L-P-P-L
(c) P-L-L-P (d) P-P-L-L

48. Thickness of biomembrane is
(a) 70-90 A (b) 7-9 mn
(c) 7-9 mu (d) All of the above

49. A barrier between protoplasm and outer environment is
(a) Cell wall (b) Cytoplasm
(c) Cell membrane (d) Tonoplast

50. Gel part and sol part of plasma membrane are
(a) Endoplasm, ectoplasm
(b) Ectoplasm, endoplasm
(c) Plasmalemma
(d) It does not show any gel and sol composition

51. Cell membrane is visible under
(a) Electron microscope (b) Light microscope
(c) U.V. microscope (d) Interface microscope

52. Who proposed the Lamellar model of biomembrane
(a) Danielle and Davson (b) Robertson
(c) Singer and Nicholson (d) Hoffmann

53. The term cell membrane was coined by
(a) Plowe (b) Danielle and Davson
(c) Nageli and Cramer (d) Robertson

54. The term plasma membrane was coined by
(a) Robertson (b) Nageli and Cramer
(c) Singer and Nicholson (d) Plowe

55. A continuous layer in plasma membrane is made by
(a) Glycoprotein (b) Extrinsic protein
(c) Intrinsic protein (d) Phospholipid

56. Basically cell membrane is made up of
(a) Phospholipid + protein
(b) Phospholipid + carbohydrate
(c) Protein + carbohydrate
(d) Glycolipid + protein

57. Fluid mosaic model was proposed by
(a) Danielle (b) Robertons
(c) Singer & Nicolson (d) Davson

58. The average thickness of plasma membrane of unit membrane model is
(a) 6.5 nm (b) 7.5 nm
(c) 7 nm (d) 8 nm

59. The most abundant lipid is the plasma membrane is
(a) Glycolipid (b) Phospholipid
(c) Lipoprotein (d) Cholestrol

60. Fluidity of plasma membrane is due to
(a) Globular head of phospholipid
(b) Tail of phospholipid
(c) Intrinsic protein
(d) Extrinsic protein

61. Biomembranes are permeable to
(a) Some substance to different degrees
(b) Impermeable to some substances
(c) Permeable to carrier proteins
(d) All of the above

62. The integral protein of plasma membrane are
(a) Superficially attached
(b) Embedded in the lipid layer
(c) Embedded in the inner most layer between two phospholipid layer
(d) Embedded in the peripheral layer

63. The most acceptable model of plasma membrane is
(a) Unit membrane model (b) Sandwitch model
(c) Fluid mosaic model (d) None of the above

64. Which of the following organelles is not membrane bound
(a) Centriole (b) Ribosome
(c) Nucleolus (d) All of the above

65. Fluid mosaic model is similar to Robertons model in
(a) Lipid arrangement
(b) Protein arrangement
(c) Number of Protein layer
(d) Presence of Glycoprotein

66. The molecular model of plasma membrane was first proposed by
(a) Robertson (b) Danielle and Davson
(c) Miller (d) Plowe

67. The elasticity of biomembrane in animal cells is due to
(a) Extrinsic protein (b) Intrinsic proteins
(c) Carbohydrates (d) Lipids

68. Carbohydrates in the membrane when linked with lipids, the complex formed is called
(a) Glycolipid (b) Sphingolipid
(c) Phospholipid (d) Cholesterol

69. "Protein iceberg in the sea of lipid" This statement was used for
(a) Unit membrane model (b) Sandswitch model
(c) Fluid mosaic model (d) Danielle model

70. Movement of the cell by undulation of the plasma membrane occurs in
(a) WBC's (b) RBC's
(c) Amoeba (d) Fibroblast

71. According to Fluid mosaic model, plasma membrane is composed of
(a) Phospholipid (b) Intrinsic proteins
(c) Extrinsic protein (d) All of the above

72. The type of lipid generally contained in biomembrane are
(a) Lecithin (b) Cephalin
(c) Cholesterol (d) All of the above

73. The channels and pumps that control traffic in & out of the cell membrane are
(a) Catalases (b) Permeases
(c) Proteases (d) Lipases

74. Plasmalemma is
(a) Selectively permeable (b) Impermeable
(c) Semipermeable (d) Permeable

75. When a part of biomembrane gets damaged
(a) Cell will stop exchange of material
(b) Cell will die of starvation
(c) Cell will grow new plasma membrane
(d) Plasma membrane will be streached to cover the damaged part

76. Channeling of molecules in plasma membrane is carried out by
(a) Glycolipids (b) Phospholipids
(c) Proteins (d) Carbohydrates

77. Functional and structural specificity of the biomembranes is because of
(a) Extrinsic proteins (b) Peripheral proteins
(c) Both (a) and (b) (d) Integral proteins

78. Which of the following substance does not pass across the membrane by simple diffusion
(a) CO_2 (b) H_2O
(c) O_2 (d) H^+

79. Fluid mosaic model is concerned with structure of
(a) Cell wall (b) Enzyme
(c) Plasma membrane (d) Nucleoplasm

80. Phospholipids are best suitable for cell membrane because they have

(a) Polar and non polar parts
(b) Glycerol
(c) Proteins binding sites
(d) None of the above

81. Cell recognition and adhesion are facilitated by certain components of the cell. These are
(a) Glycoproteins and glycolipids
(b) Proteins
(c) Fatty acids
(d) Lipids

82. The enzyme associated with plasma membrane is
(a) Amylase (b) Permease
(c) Lipase (d) Catalase

83. In trilaminar structure, proteins are held with phospholipids by
(a) Electrostatic forces (b) Ionic bond
(c) Hydrophobic attraction (d) All of the above

84. Which of the following protein are peripheral in biomembranes
(a) ATPase (b) Acetylcholinesterase
(c) Spectrin (d) All of the above

85. Quasi fluid state of biomembrane enable it to undergo
(a) Growth (b) Division
(c) Dynamic changes (d) Selectively permeable

86. Which one of the following are believed to have channels through which water soluble materials can pass into the cell?
(a) Peripheral proteins
(b) Fibrous integral proteins
(c) Globular integral protein
(d) Oligosaccharides

87. Marine bird penguine drink sea water and eliminate excess of NaCl through
(a) Nasal glands (b) Their faeces
(c) Their urine (d) Their skin

88. Which component of the mitochondria act as ATP synthetase
(a) F site of oxisome (b) Fo site of oxisome
(c) F5-6 site of oxisome (d) Mitochondrial matrix

89. Nucleus was discovered by
(a) Robert Brown (b) Robert Hook
(c) Benda (d) Palade

90. Fibrous lamina is a component of
(a) Nuclear membrane (b) Nucleoplasm
(c) Nucleolus (d) Chromatin

91. Genes are active in
(a) Euchromatin (b) Heterochromatin
(c) Chromocenter (d) Centromere

92. Largest cell organelle is
(a) Nucleus (b) Mitochondria
(c) Peroxisome (d) Ribosomes

93. Nucleolus was discovered by
(a) Robert Brown (b) Fontana
(c) Kolliker (d) Benda

94. Director of the cell is
(a) Ribosome (b) Nucleus
(c) Mitochondria (d) Plastids

95. GERL is rich in
(a) Glucose-6-phosphate (b) Proteins
(c) Acid phosphatase (d) Carbohydrates

96. Zone of exclusion is found around
(a) Mitochondria (b) Ribosome
(c) Lysosome (d) Golgi complex

97. Presence of a central hub is the characteristic of
(d) Centriole (b) Cilia
(c) Flagella (d) None of the above

98. Triplets of centriole are bent over at an angle of
(a) 10° (b) 20°
(c) 30° (d) 40°

99. The number of dynein arms attached to each doublet of cilia is
(a) 1 (b) 2
(c) 3 (d) 4

100. Granules of nucleolus are precursor of
(a) Lysosome (b) Ribosome
(c) RNA (d) Chromosome

101. An animal cell with numerous nuclei is called
(a) Coenocytic (b) Syncitium
(c) Plasmodium (d) Both (a) and (b)

102. When cilia of a row beat one after the other, the type of movements is called
(a) Metachronous (b) Isochronous
(c) Both (a) and (b) (d) Synchronous

103. Which organelle is having flattened cisternae near the nucleus
(a) Mitochondria (b) Nucleolus
(c) Centrbsome (d) Golgi complex

104. Ribosomes are granules formed of
(a) rRNA+ protein (b) rRNA + carbohydrates
(c) mRNA +glycolipid (d) Proteins + mRNA

105. SER has
(a) More lipid synthetase
(b) More protein synthetase
(c) Both a + b in equal proportion
(d) No synthetases

106. Which organelle is attached to both plasma membrane and the nuclear membrane
(a) Golgi complex (b) ER
(c) Intermediate filaments (d) Lysosomes

107. Gastric cells secreting zymogen have well developed
(a) SER (b) RER
(c) Mitochondria (d) Plastids

108. Enzyme rich organelle is
(a) Nucleus (b) Lysosome
(c) Mitochondria (d) Ribosome

109. Polysomes are the different ribosomes attached to the same
(a) mRNA (b) ER
(c) Golgi complex (d) t-RNA

110. Palade granules are
(a) Pigment granules (b) Ribosomes
(c) Excretory vesicles (d) RER

111. Golgi vesicles are more towards
(a) Concave side (b) Convex side
(c) Equally distributed (d) None of the above

112. Antiseptic properties of saliva is due to
(a) Lipofuschin (b) Lysozyme
(c) Amylase (d) Ptylin

113. A branch dealing with the study of cell is
(a) Cytology (b) Histology
(c) Morphology (d) Anatomy

114. The fuctional unit of Golgi complex is
(a) Cisternae (b) Oxisome
(c) Thylakoid (d) Cristae

115. Peroxisomes are rich in enzyme
(a) Oxidase (b) Hydrolase
(c) Transferase (d) Isomerase

116. Nucleoprotein are synthesised in
(a) Nucleus (b) Nucleolus
(c) Cytoplasm (d) Nucleoplasm

117. Smooth endoplasmic reticulum/granular ER is having more
(a) Ribosome + Cisternae + Tubules
(b) Cisternae + Tubules + Vesciles
(c) Cisternae + Vesicles + Ribosome
(d) Tubules + vesicles

118. Nucleolus is involved in the synthesis of
(a) tRNA (b) rRNA
(c) mRNA (d) Protein

119. Maximum mitochondria are found in
(a) Liver cell (b) Sperm
(c) Flight muscles (d) Kidney cell

120. Redox reactions occur in
(a) Mitochondria (b) Lysosomes
(c) Golgi complex (d) Ribosome

121. The organelle involved in the production of tears, saliva, sweat and hormones is
(a) ER (b) Golgi complex
(c) Mitochondria (d) Microfilaments

122. Lipofuscin granules are
(a) Digestive vacuoles (b) Residual bodies
(c) Hydrolytic enzyme (d) Lysosomes

123. What will happen to the cell if lysosomes burst due to excess of labilizers
(a) Cell will die
(b) Cells growth will stop
(c) Cells nucleus stop functioning
(d) All the organelles stop functioning till the more lysosomes are produced

124. Steroid hormones like progesterone, ergosterone are synthesised by
(a) SER (b) RER
(c) Golgi complex (d) Ribosomes

125. Glycosylation of proteins starts in
(a) ER (b) Ribosome
(c) Golgi complex (d) Lysosome

126. The pores in nuclear envelope have a diameter of about
(a) 600 A (b) 60 A
(c) 6 A (d) 0.6 A

127. Golgi bodies get blue stain with
(a) Crystal violet (b) Sudan black III
(c) Basic fushin (d) Haematoxylin

128. Packaging of newly formed proteins is done in
(a) Ribosome (b) ER
(c) Golgi complex (d) Vesicles

129. Lipofuscin granules in nerve cells are
(a) Primary lysosome (b) Secondary lysosome
(c) Tertiary lysosome (d) Autophagic lysosome

130. The number of nucleoli increases in the yolky eggs during their formation as they participate in synthesis of
(a) rRNA (b) mRNA
(c) tRNA (d) All of the above

131. One of the following can never contain RN A
(a) Nucleolus (b) Virus
(c) Plasmalemma (d) Nucleus

132. The number of cell organelles can be kept in control by which of the following organelle?
(a) Oxisome (b) Lysosome
(c) Mitochondria (d) All of the above

133. The basophillic ergastoplasm in gland cells indicate the richness of
(a) Mitochondria (b) DNA
(c) Ribosomes (d) Golgi apparatus

134. The formation and storage of RNA is related to
(a) Mitochondria (b) Centriole
(c) Nucleus (d) Chloroplast

135. Storage of enzymes for the digestion of cellular component as proteins and carbohydrates is carried out by
(a) Mitochondria (b) Lysosomes
(c) Centriole (d) Ribosomes

136. The cell organelle famous as power house of the cell is
(a) Nucleus (b) ER
(c) Mitochondria (d) Ribosomes

137. Centre of phosphorylation is
(a) Oxisome (b) Peroxisome
(c) Ribosome (d) Mitochondria

138. DNA can be traced in
(a) Peroxisome (b) Lysosome
(c) Golgi body (d) Mitochondria

139. One of the following help in removing the damaged cells in multicullular organism
(a) Liposomes (b) Glyoxysomes
(c) Peroxisomes (d) None of the above

140. The function of peroxisome is
(a) H_2O_2 destruction
(b) Conversion of fats to carbohydrates
(c) Detoxification of heavy metals
(d) Oxidative phosphorylation

141. One of these is incorrect
(a) Lysosomes have hydrolytic enzymes
(b) Lysosome are autophagic
(c) Lysosome can dissolve carbohydrates, nucleic adds, prqteins and lipids
(d) All lysosome are same structurally and functionally

142. RER is abundant in cells undergoing
(a) Lipid synthesis (b) Protein synthesis
(c) Glyoxylate cycle (d) All of the above

143. Nucleus equivalent of bacteria and cynobacteria is called
(a) Genophore (b) Genotype
(c) Incipient nucleus (d) All of the above

144. Electron microscope has revealed the presence of
(a) Ribosomes (b) Chromosomes
(c) Chloroplast (d) Leucoplast

145. Centriole/centrosome takes part in
(a) Nucleus formation (b) Start of cell division
(c) Cell plate formation (d) Spindle formation

146. Inner membrane convolution of a mitochondria are known as
(a) Lamellae (b) Thylakoids
(c) Grana (d) Cristae

147. Which one is non living cell inclusion
(a) Golgi complex (b) Centrosome
(c) Vacuole (d) Ribosome

148. Export house of cell is
(a) ER (b) Golgi body
(c) Nucleus (d) Lysosome

149. Gastric cells secreting zymogen have well developed
(a) SER (b) RER
(c) Lysosomes (d) Mitochondria

150. Flat membranous bags are characteristic of
(a) Peroxisomes (b) Mitochondria
(c) Lysosomes (d) Golgi bodies

151. Both oxisomes and quantosome occurs in
(a) Chromosome (b) Autosomes
(c) Ribosome (d) None of the above

152. Ribosome is often called
(a) Microsome (b) RNA particle
(c) Dictyosome (d) Oxisome

153. Which of the following statements are not true:
I. Nissle granules in the neurons are ribosomes
II. Bound and free forms of ribosomes are inter changeable
III. F0 - F1 are the non functional unit of mitochondria
IV. Lysozymes work at pH 5

Codes :
(a) I, III (b) III, IV
(c) Only I V (d) I, II , III

154. Match the scientist with the organelle discovered by them

Column I	Column II
(A) Nucleus	(I) Palade
(B) ER	(II) Porter
(C) Lysosome	(III) Christian de Duve
(D) Ribosome	(IV) Robert Brown

Codes:

	A	B	C	D
(a)	I	II	III	IV
(b)	IV	II	III	I
(c)	III	II	I	IV
(d)	IV	III	II	I

155. Match the following

Column I	Column II
(A) Little nucleus	(I) Golgi complex
(B) Acrosome	(II) 9 + 0 microtubule
(C) Centriole	(III) Nucleolus
(D) Cilia	(IV) 9 + 2 microtubule

Codes:

	A	B	C	D
(a)	III	I	II	IV
(b)	III	II	IV	I
(c)	I	II	III	IV
(d)	IV	II	III	I

156. Match the following columns:

Column I	Column II
(A) Acid hydrolase vesicles	(I) Ribosome
(B) RNA particles	(II) Mitochondria
(C) Sarcosome	(III) Lysosome

Codes:

	A	B	C
(a)	III	I	II
(b)	II	I	III
(c)	I	II	III
(d)	III	II	I

157. Ribosome get attached to the R E R by means of protein
(a) Ligase (b) Actin
(c) Ribophorin (d) Triphosphatase

158. ER is absent in all except one
(a) Mature RBC's (b) Embryonic cells
(c) Prokaryotes (d) Liver cells

159. Golgi complex originate from
(a) Ribosome (b) Cell plate
(c) Nuclear membrane (d) ER

160. Maturing face of Golgi apparatus is towards
(a) Plasma membrane (b) Nuclear membrane
(c) Centriole (d) Mitochondria

161. Golgi complex is present in all the following cells except one
(a) Kidney cell (b) Prokaryotes
(c) Liver cell (d) Sperm

162. Which work is performed by Golgi complex
(a) Formation of acrosome
(b) Recycling of plasma membrane
(c) Formation of cell plate during cytokinesis
(d) All of the above

163. 70S ribosomes are found in
(a) Bacteria (b) Chloroplast
(c) Mitochondria (d) All of the above

164. Oxisomes are present on the
(a) ER
(b) Ribosome
(c) Inner membrane of mitochondria
(d) Outer membrane of mitochondria

165. Which protein is present in microtubules
(a) Actin (b) Myosin
(c) Troponin (d) Tubulin

166. The lysosomes with inactive enzymes are called
(a) Primary lysosome (b) Secondary lysosome
(c) Autophage (d) Residual body

167. The 70S ribosome has two sub units as
(a) 35S + 35S (b) 30S + 40S
(c) 50S + 30S (d) 60S + 40S

168. Which is the smallest known cell organelle
(a) Golgi complex (b) Ribosome
(c) Lysosome (d) Mitochondria

169. Flagellum ofeukaryotes show arrangement of microtubules
(a) 9 + 2 arrangement (b) 2 + 9 arrangement
(c) 9 + 0 arrangement (d) 0 + 9 arrangement

170. Which of these organelles is not self replicating
(a) Mitochondria (b) Plastid
(c) Centriole (d) Ribosome

171. Ribosomes are the sites of
(a) Photosynthesis (b) Steroid synthesis
(c) Protein synthesis (d) Respiration

172. Which of the following form supportive frame work of the cell
(a) Microfilament (b) Microtubule
(c) Intermediate filaments (d) All of the above

173. Engine of the cell is
(a) Chloroplast (b) Mitochondria
(c) Nucleus (d) Ribosome

174. Aerobic respiration is performed by
(a) Mitochondria (b) Glyoxisome
(c) Lysosome (d) Chloroplast

175. ET chain occurs in
(a) Ribosome (b) Cytoplasm
(c) Oxisome (d) Peroxisomes

176. Mitochondria are absent in
(a) Algae cell (b) Liver cell
(c) RBCs (d) Embryo cell

177. Polymorphic organelle in the following is
(a) Mitochondria (b) Golgi complex
(c) Lysosome (d) Peroxisome

178. Which of these organelle is without membrane
(a) Lysosome (b) Vacuoles
(c) Ribosome (d) Cilia

179. Wornout cell organelles are digested by
(a) Lysosome (b) Peroxisome
(c) Glyoxisome (d) Ribosome

180. Circular DNA is present in
(a) Mitochondria, eukaryotic cell
(b) Prokaryotic cell, mitochondria
(c) Ribosome, prokaryotic cell
(d) None of the above

181. Which ion concentration is required to unite sub units of ribosomes
(a) 0.1 M Mg^{+2} (b) 0.01 M Mg^{+2}
(c) 0.001 M Mg^{+2} (d) 1M Mg^{+2}

182. The lysosome hydrolases work at
(a) Neutral pH (b) Acidic pH
(c) Alkaline pH (d) Any pH

ANSWERS

1. (d)	**2.** (c)	**3.** (d)	**4.** (c)	**5.** (a)	**6.** (d)	**7.** (b)	**8.** (b)	**9.** (b)	**10.** (b)
11. (b)	**12.** (d)	**13.** (c)	**14.** (d)	**15.** (d)	**16.** (b)	**17.** (b)	**18.** (c)	**19.** (c)	**20.** (a)
21. (c)	**22.** (c)	**23.** (d)	**24.** (d)	**25.** (d)	**26.** (d)	**27.** (c)	**28.** (d)	**29.** (a)	**30.** (a)
31. (a)	**32.** (c)	**33.** (d)	**34.** (d)	**35.** (b)	**36.** (d)	**37.** (b)	**38.** (a)	**39.** (c)	**40.** (c)
41. (a)	**42.** (a)	**43.** (b)	**44.** (b)	**45.** (c)	**46.** (b)	**47.** (c)	**48.** (d)	**49.** (c)	**50.** (a)
51. (a)	**52.** (a)	**53.** (c)	**54.** (d)	**55.** (d)	**56.** (a)	**57.** (c)	**58.** (b)	**59.** (b)	**60.** (b)
61. (d)	**62.** (b)	**63.** (c)	**64.** (d)	**65.** (b)	**66.** (b)	**67.** (d)	**68.** (a)	**69.** (c)	**70.** (d)
71. (d)	**72.** (d)	**73.** (b)	**74.** (a)	**75.** (c)	**76.** (c)	**77.** (c)	**78.** (d)	**79.** (c)	**80.** (a)
81. (a)	**82.** (b)	**83.** (d)	**84.** (d)	**85.** (c)	**86.** (c)	**87.** (a)	**88.** (a)	**89.** (a)	**90.** (b)
91. (a)	**92.** (a)	**93.** (b)	**94.** (b)	**95.** (c)	**96.** (d)	**97.** (a)	**98.** (d)	**99.** (b)	**100.** (b)
101. (b)	**102.** (c)	**103.** (d)	**104.** (a)	**105.** (a)	**106.** (b)	**107.** (b)	**108.** (c)	**109.** (a)	**110.** (b)
111. (a)	**112.** (b)	**113.** (a)	**114.** (a)	**115.** (a)	**116.** (c)	**117.** (d)	**118.** (b)	**119.** (c)	**120.** (a)
121. (b)	**122.** (b)	**123.** (a)	**124.** (a)	**125.** (a)	**126.** (a)	**127.** (b)	**128.** (b)	**129.** (c)	**130.** (a)
131. (c)	**132.** (b)	**133.** (c)	**134** (c)	**135.** (b)	**136.** (c)	**137.** (a)	**138.** (d)	**139.** (d)	**140.** (a)
141. (d)	**142.** (b)	**143.** (a)	**144.** (a)	**145.** (d)	**146.** (d)	**147.** (c)	**148.** (b)	**149.** (b)	**150.** (d)
151. (d)	**152.** (b)	**153.** (a)	**154.** (b)	**155.** (a)	**156.** (a)	**157.** (c)	**158.** (d)	**159.** (d)	**160.** (a)
161. (b)	**162.** (d)	**163.** (d)	**164.** (c)	**165.** (d)	**166.** (a)	**167.** (c)	**168.** (b)	**169.** (a)	**170.** (d)
171. (c)	**172.** (d)	**173.** (d)	**174.** (a)	**175.** (c)	**176.** (c)	**177.** (c)	**178.** (c)	**179.** (a)	**180.** (b)
181. (c)	**182.** (b)								

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4. (c) Micrographia is a book written by Robert Hook after he discovered the cell.

5. (a) Prokaryotes are without membrane bound organelles so there are no different compartments in the cell.

9. (b) Ribosomes are the protein factories present in both prokaryote and eukaryote cells.

15. (d) Bacteria is a prokaryotic cell, all the enzymes of cellular respiration are present in their cell membrane and mesosome.

16. (b) Muramic acid is a amino acid derivative or peptidoglycan.

26. (d) Amoeba is a eukaryotic cell with membrane bound nucleus and other organelles whereas bacteria and blue green algae are prokaryotic cells and mature RBC's are without nucleus.

38. (a) The type of basic protein present in eukaryotic cell is histonic protein. It is present in the ratio I : 1 with the DNA.

63. (c) Fluid mosaic model explains the dynamic structure of plasma membrane.

67. (d) Lipids are made up of fatty acids which provide elasticity to the biomembrane.

76. (c) Channeling of molecules in the plasma membrane is carried out by tunnel proteins.

77. (c) The term extrinsic & peripheral proteins are synonyms, They are meant for recognition and antigenic properties.

82. (b) Permease enzyme facilitates the movement of contents through cell membrane.

108. (c) Mitochondria carries about 70% of the total cell enzymes.

115. (a) Peroxisomes are rich in enzyme oxidase and catalase.

121. (b) Golgi complex is having secretory function.

123. (a) When lysosomes burst, all its enzymes are released and engulf the complete cell organelles.

158. (d) Liver cells are having both rough and smooth ER.

177. (c) Lysosomes exist as primary, secondary, tertiary and autophagic forms.