A Project of Stars Academy Lahore.

STARS ENTRY TEST SERIES

BIOLOGY

MDCAT UHS, NUMS, AMC FMDC, AGA KHAN MEDICAL & DENTAL COLLEGES ADMISSION TEST

Editor:

Prof. Awais Bhatti

BS (Honours) Zoology

DIRECTOR ENTRY TEST MESSAGE

Heading and leading the Entry Test Department is a task, which is fairly challenging, given the constantly changing trends in the papers set by UHS, UET, PIEAS, GIKI, NUST, FAST, Air University etc. In 2017, STARS Academy Lahore bagged 3rd position simultaneously in UHS Punjab & AJK; while in 2018, 4th position in UHS Punjab & 1st one from UHS-AJK. STARS ACADEMY gracefully took 3rd position in NUMS as well in 2018. This is how the series of achievements travels on & on at STARS ACADEMY Lahore.

Thanks to all the team of STARS Entry Test Department which keeps vigil with me to complete the task of making books. I would like to pay my humble but luxurious gratitude to the CEO of STARS Colleges & Academies, Adil Khaleaque, for lending unflinching trust to my credentials to grapple with the complex versions of varied Entry Tests including the supervision of the making of books. I hope this book in hand will befit the standards while satiating the academic needs of students and teachers alike.

Muhammad Tahir Iqbal
Director, Entry Test Department
STARS Group of Colleges & Academies

EDITORIAL BOARD

Director Entry Test Department
Prof. Tahir Iqbal
tahiriqbalstars@gmail.com
0321-4693044

Manager Entry Test Department
Prof. Rana Sulman
sulman@stars.edu.pk
0321-4132426

CONTENTS

BIOLOGY

Table of Contents

1 The Cell

COURSE CONTENT

- Light and Electron Microscope (Magnification and Resolution)
- Structure of Typical Animal and Plant Cell
- Fluid Mosaic Model of Cell Membrane
- Transport of Material across the cell Membrane: Active transport, Passive transport, Endocytosis and Exocytosis
- Eukaryotic Cell Structures: Endoplasmic reticulum (RER & SER), Ribosomes, Golgi apparatus, Lysosomes, Vacuoles, Centrioles & Microtubules, Mitochondria, Chloroplast and Nucleus (nuclear membrane, nucleolus and chromosomes)
- Prokaryotic Cell & Eukaryotic cell.

2 Biological Molecules

COURSE CONTENT

- Carbohydrates: Monosaccharides, Disaccharides and Polysaccharides (Starch, Glycogen & Cellulose)
- Lipids: Triglycerides, Phospholipids and their functions.
- Proteins: Amino Acids & Peptide bond formation, Structures of Proteins (primary, secondary, tertiary and quaternary structures) and Globular & Fibrous Proteins
- Nucleic acids: DNA, RNA and Types of RNA
- Water: Heat of vaporization, Specific Heat Capacity and Solvent Action
- Enzyme: Definition, Characteristics of, Mechanism of Enzyme Action Enzymes (Lock & key model and Induced fit model), Factors affecting the rate of Enzyme Action, Inhibitors

3 Chromosomes and DNA

COURSE CONTENT

- Chromosome: Nucleosome, DNA, Histone Proteins, Chromatids, Centromere and Telomeres.
- Gene as a Basic Unit of Genetic Information
- DNA Replication: Hypothesis of DNA Replication, Meselson & Stahl's experiment and Replication
- Transcription
- Genetic Code
- Translation

4 Cell Division

COURSE CONTENT

- Cell Cycle: Interphase (G1, S and G2 phases), Mitotic phase and Cytokinesis
- Mitosis: Process of Mitosis, Significance of Mitosis
- Meiosis: Process of Meiosis and significance of Meiosis

5 Variety of Life

COURSE CONTENT

- Kingdoms: Protoctista, Fungi, Plantae and Animalia
- Viruses: Structure of Viruses
- AIDS: Causative Agent, Modes of Transmission and Prevention & Control

6 Bioenergetics

COURSE CONTENT

- Photosynthetic Pigments (Chlorophylls and Carotenoids)
- Absorption and Action Spectra
- Light – Dependent Reactions (cyclic and non – cyclic phosphorylation) and light – Independent Reactions (Calvin cycle).
- Cellular Respiration: Glycolysis, Link reaction / Pyruvic Oxidation, Krebs's Cycle (with reference to production of NADH, FADH and ATP) and ETC
- Anaerobic Respiration and its Types (Alcoholic and Lactic Acid Fermentation).

7 Gas Exchange

COURSE CONTENT

- Anatomy of Human Respiratory System.
- Transport of Respiratory Gases: O_2 & CO_2 and Role of Haemoglobin as Respiratory Pigment.
- Respiratory Disorders: Tuberculosis, Emphysema and Lung Cancer

8 Transport in Plants

COURSE CONTENT

- Transport of Water and Minerals: Apoplast & Symplast Pathway and Cohesion, Transpiration Pull / Tension & Adhesion
- Transpiration, Factors affecting it and opening and closing of Stomata.
- Translocation according to Pressure Flow Theory
- Xerophytes

9 Transport in Human

COURSE CONTENT

- Heart: Structure of heat, Cardiac Cycle, Control of Heart Beat, ECG and Blood Pressure
- Blood Vessels: Arteries, Veins and Capillaries
- Blood: Plasma and Blood Cells (RBCs, WBCs and platelets).
- Lymphatic System

10 Immunity

COURSE CONTENT

- Immune System and its Components
- Types of Immunity
- Vaccination

11 Homeostasis

COURSE CONTENT

- Homeostasis
- Thermoregulation in Mammals
- Human Urinary System

12 Muscles and Movement

COURSE CONTENT

- Structure and Function of Skeletal Muscle

- Mechanism of Skeletal Muscle Contraction: Sarcomere, Ultrastructure of Myofilaments, Sliding Filament, Control of Actin – Myosin Interaction and use of Energy for Muscle Contraction.

13 Communication

COURSE CONTENT

- Nervous Coordination in Mammals
- Neurons: Sensory, Intermediate / relay and motor neurons
- Reflex are / Reflex action
- Nerve impulse
- Synapse
- Hormones: Definition & Types of Hormones, Hormones of islets of Langerhans (Insulin & Glucagon) and Role of ADH in Osmoregulation.
- Plants Hormones: Auxins, Gibberellins and Abscisic Acid

14 Reproduction

COURSE CONTENT

- Gametogenesis: Spermatogenesis and Oogenesis
- Hormonal control of Human Menstrual Cycle (FSH, LH, estrogen and progesterone)

15 Genetics

COURSE CONTENT

- Basics of Genetics: Gene, Locus, Allele, Gene Pool, Phenotype, Genotype, Homozygous, Heterozygous, Dominant Allele, Recessive Allele, Complete Dominance, Dominance, Linkage, F1 & F2 Generations, Mutation and Multiple Allele.
- Gene Linkage: Crossing over and Recombination Frequency / Cross Over Value
- Continuous and Discontinuous Variations
- Punnet square, Test cross and Monohybrid & Monohybrid & Dihybrid Crosses
- Gene Linkage and Sex Linkage in Human (Human (Haemophilia and Colour Blindness)

16 Biotechnology

COURSE CONTENT

- Recombinant DNA Technology / Genetic Engineering: Principles of Recombinant DNA Technology and its Application, PCR Gel Electrophoresis and DNA Analysis / Finger Printing
- Gene Therapy
- Transgenic Organisms (Bacteria, Plants and Animals)

17 Evolution

COURSE CONTENT

- Theory of natural selection
- Hardy – Weinberg theorem and factors affecting gene / allele frequency

---

- The pattern of Question Paper is generally to be in conformance but, not limited to the guidelines given.
- The above guidelines are meant for general facilitation of students. Final paper setting is the sole prerogative of UHS Lahore, however.

CHAPTER 01

CELL BIOLOGY

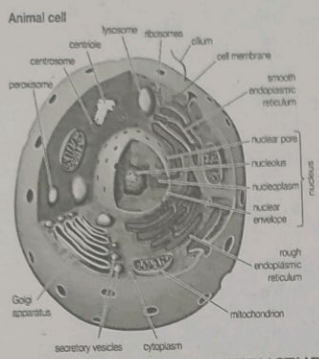
COURSE CONTENT

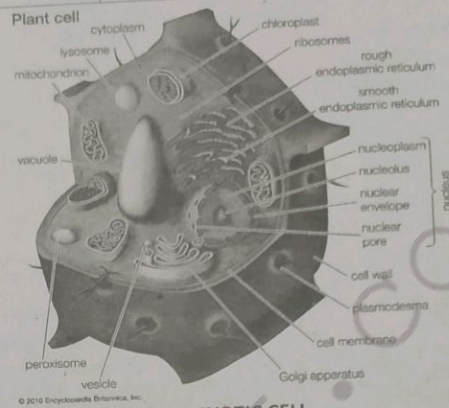
- Light and Electron Microscope (Magnification and Resolution)
- Structure of Typical Animal and Plant Cell
- Fluid Mosaic Model of Cell Membrane
- Transport of Material across the cell Membrane: Active transport, Passive transport, Endocytosis and Exocytosis
- Eukaryotic Cell Structures: Endoplasmic reticulum (RER & SER), Ribosomes, Golgi apparatus, Lysosomes, Vacuoles, Centrioles & Microtubules, Mitochondria, Chloroplast and Nucleus (nuclear membrane, nucleolus and chromosomes).
- Prokaryotic Cell & Eukaryotic cell

A) STRUCTURE OF TYPICAL ANIMAL AND PLANT CELL

Features	Animal Cell	Plant Cell
Cell wall	Absent Enclosed by plasma membrane only.	Present In addition to plasma membrane, mostly surrounded by a thick cell wall.
Plastids	Plastids absent.	Plastids (chloroplast and chromoplast) are very common.
Glyoxysomes	Absent	Present
Centrosome (centrioles)	Possess centrosome with one or two centrioles.	No centrioles present; instead two small clear area called polar caps are present.
Mitotic Apparatus	Spindles and Asters	Spindles only
Cytokinesis	Inwards	Outwards
Lysosomes	Present	Absent
Golgi Bodies	Prominent and highly complex Golgi bodies.	Contain several subunits of Golgi bodies called **Dictyosomes.**
Flagella	Present	Absent
Phagocytosis	Present	Absent
Nucleus	Central	Peripheral
Vacuoles	Cytoplasm consists largely of smaller vacuole.	Cytoplasm peripheral, central space occupied by a larger vacuole.
Storage Products	Glycogen	Starch
Size	Usually smaller in size.	Comparatively larger in size.
Shape	Mostly **round** and **irregular** in shape	Have fixed, **rectangular** shapes.

Gametogenesis	By meiosis	By mitosis
Cell turgidity	Rupture by water	Turgid by water
Cilia	Present	Absent

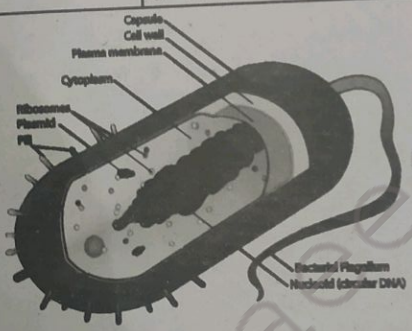


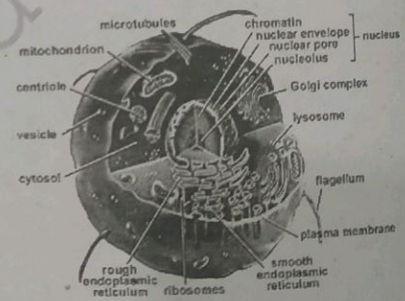


B) COMPARE & CONTRAST STRUCTURE OF PROKARYOTIC & EUKARYOTIC CELL

Property	PROKARYOTIC CELL	EUKARYOTIC CELL
Nuclear membrane	Since there is no nuclear membrane therefore no distinct nucleus.	Present
Chromatin material	The genetic material (DNA) is without any nuclear membrane and freely present in the cytoplasm.	A nucleus is present in which nuclear material (chromosomes) is enclosed in double nuclear membrane.
Membrane bound structures	Prokaryotic cells lack many of the membrane bounded structures i.e. mitochondria, endoplasmic reticulum, chloroplasts and Golgi apparatus.	Membrane bound structures present
Ribosomes	Ribosomes are 70S. Smaller subunit is 30S while larger subunit is 50S.	Ribosomes are 80S. Smaller subunit is 40S while larger subunit is 60S.
Type of DNA	Circular DNA	Linear DNA
Cell membrane	Sterols absent	Sterols present
Cell wall	Cell wall is composed of peptidoglycan or murein. When polysaccharide chains are bound covalently to shorter chains of amino acids, peptidoglycan is formed. The entire cell wall is considered as a single complex molecule called **Sacculus**.	The cell wall if present is formed of cellulose in most of the plant cells and is formed of chitin in fungi.
Cell Division	In prokaryotes mitosis is missing and	Cell divides by Mitosis. / Meiosis

	the cell divides by binary fission.	
omposition of agella	Flagellin protein present	Tubulin protein present
Organisms	Organisms possessing prokaryotic cells are called Prokaryotes.	Organisms eukaryotic cells are called eukaryotes.
Origin/ evolution	Prokaryotes represent primitive stage of evolution. 3.5 Billion Years ago	Eukaryotes probably evolved from prokaryotes. 1.5 Billion Years ago
Cytoskeleton	Absent	Present
Cell size	10 – 100 μm	1 – 10 μm
Photosynthesis Pigments Photosystem	Chlorophyll a Photosystem II (Cyanobacteria).	Chlorophyll b Photosystem I & II
ATP production	1 glucose = 38 ATP	1 glucose = 36 ATP
Histones	Absent	Present
Transcription	Promoter sequence -10, - 35	Promoter sequence -25, - 75
Translation	Simple , RNA Polymerase	Complex, RNA Polymerase I,II,III.
Examples	Prokaryotes include 1. Bacteria 2. Cyanobacteria 3. Archaeo bacteria	Eukaryotes include all other unicellular or multicellular organisms such as animals, plants, fungi and Protista.

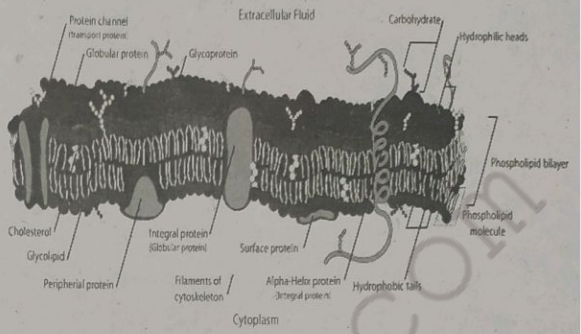




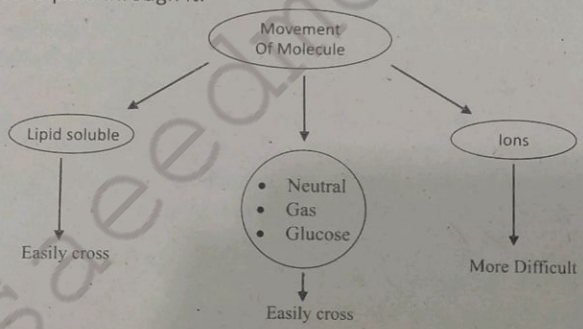
Classification of Organelles

Non - Membranous Organelles	Single - Membranous Organelles	Double - Membranous Organelles
Centrioles	Peroxisomes	Mitochondria
Cytoskeleton	Glyoxysomes	Nucleus
Ribosomes	Golgi apparatus	
	Lysosomes	
	Endoplasmic Reticulum	

Define the term diffusion, facilitated diffusion, active and passive transport endocytosis and exocytosis and explain the basics of Fluid mosaic model of cell membrane



- Cell membrane is the outer most boundary of the animal cell while covered by cell wall in a plant, Fungi , Prokaryotes
- Chemically composed of Proteins (60 – 80%), Lipids (20 – 40%) and small amount of carbohydrates.
- According to **Unit Membrane model (This model was presented by J. David Robertson in 1959),** the cell membrane is composed of lipid bilayer sandwiched between inner and outer layer of protein.
- This structure has hydrophobic component i.e. central non-polar part of Phospholipids molecule and a hydrophilic part i.e. outer polar component of phospholipid + globular protein.
- Modern technology has revealed that lipid bilayers are not sandwiched between protein layers.
- **According to fluid mosaic model (This model was proposed by S. J. Singer and G.L. Nicholson in 1972)**, protein layers are not continuous and are not confined to the surface of the membrane but are embedded in lipid layers in a mosaic manner. These protein molecules may function as a gateway (charged pore) for the transport of materials. This model at present is the most accepted one.
- Cell membrane is a differentially permeable or selectively permeable membrane, allowing only the selective substances to pass through it.



Passive transport	Active transport
High concentration to Low concentration	Low concentration to high concentration
Along the concentration gradient	Against the concentration gradient
Downhill movement	Uphill movement
Energy not required	Energy required

Diffusion

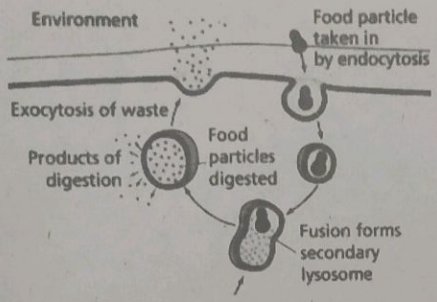
- Movement of solute molecules from higher concentration to lower concentration is called diffusion e.g. movement of gases.

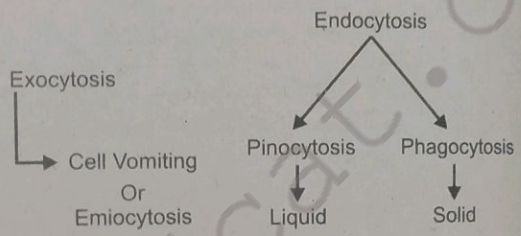
Osmosis

- Movement of water molecules across the membrane from higher water potential to lower water potential is called osmosis.

Facilitated Diffusion

- It is a type of carrier mediated transport in which molecules move from higher concentration to lower concentration with help of carrier proteins.





Endocytosis and Exocytosis

- Intake of materials along the infoldings of cell membrane in the form of vacuole is called endocytosis.
- Intake of material in solid form is called **phagocytosis** while in fluid form is called **pinocytosis.**
- In neurons, the plasma membrane transmits nerve impulses to keep coordination in body by generating ionic gradient.

C) Outline the structure and function of the following organelles:
Nucleus, Endoplasmic reticulum, Golgi apparatus, Mitochondria, Centrioles, Ribosomes, Lysosomes, Cytoskeleton, Vacuole and Chloroplast.

NUCLEUS

- These are most important organelles of the cell.
- They are visible only in non-dividing cells.
- In animal cell they are central in position.
- In plant cells they are pushed to periphery due to the presence of large vacuole.
- They may be irregular or spherical in shape.
- A cell containing single nucleus is called **Mononucleate** (Human cells e.g Smooth, Cardiac Muscles & sperm cells), two as **Binucleate** (In human e.g Cells of Telophase) and with more than two as **Multinucleate** (E.g Skeleton Muscles).
- It contains DNA, RNA and proteins including enzymes.
- Nucleus in composed of nuclear membrane, nucleoli, nucleoplasm and chromosomes or chromatin network. .
- ***Nuclear membrane*** separates the nuclear materials from the cytoplasm.

- It is a double layered structure. Outer layer continuous with the endoplasmic reticulum and the inner one encloses the nuclear contents.
- ***Nuclear pores*** results from the fusion of outer and inner membranes. They act as a gateway for the exchange of materials with the cytoplasm. Their number is variable depending upon the differentiation of the cell i.e. undifferentiated cells like eggs have 30,000 pores / nucleus while erythrocyte, a well differentiated cells have 3 – 4 pores / nucleus.

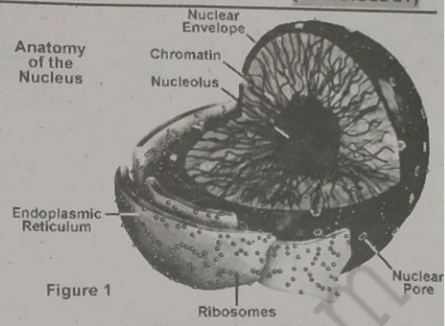
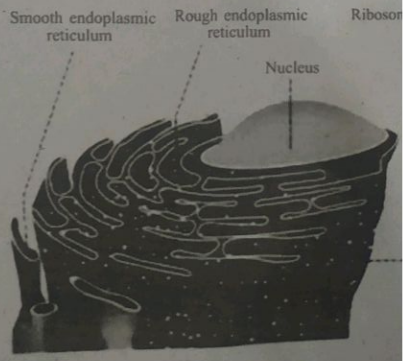


Figure 1

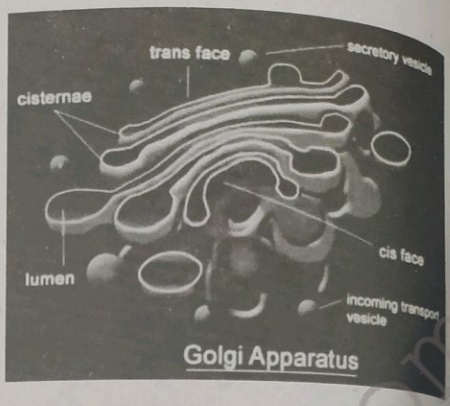
- ***Nucleolus*** is non-membranous, darkly stained body within the nucleus.
- Nucleoli may be one or more.
- RNA (rRNA) is synthesized and stored in it.
- Nucleolus is composed of two regions: peripheral granular area containing precursors for ribosoma subunits and central fibril area containing RNA and rDNA.
- Each ***chromosome*** is a thread like structure resulting from organization of chromatin materia during cell division.
- Under compound microscope they appear to be made of arms (chromatids) and a centromere, th place where spindle fibers are attached during cell division.
- Centromere is the place on the chromosome and Kinetochore is a place on centromere wher spindle fibers are attached during cell division.
- Chemically chromosomes are composed of DNA and protein.

ENDOPLASMIC RETICULUM

- Network of interconnected channels extending and often continuous with cell membrane to th nuclear membrane is called endoplasmic reticulum.
- They vary in appearance from cell to cell.
- Cisternae are spherical or tubular membranes which separate the material present in the channels from that of cytoplasmic material.
- **Rough E.R** = One with ribosomes attached to its external surface.
- **Smooth E.R**= One without ribosomes.
- They provide mechanical support to the cell, so that its shape is maintained
- They are also involved in transport of materials from one part of the cell to the other.
- RER are involved in the synthesis of proteins. After synthesis, they are either stored in the cytoplasm or transported out of the cell through these channels.
- SER help in metabolism of various types of molecules particularly lipids.
- SER help in detoxifying harmful drugs.
- SER are also responsible for the transmission of impulses e.g., in muscles cells and nerve cells.



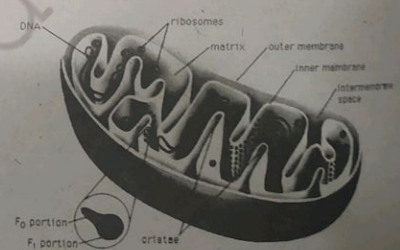
GOLGI APPARATUS

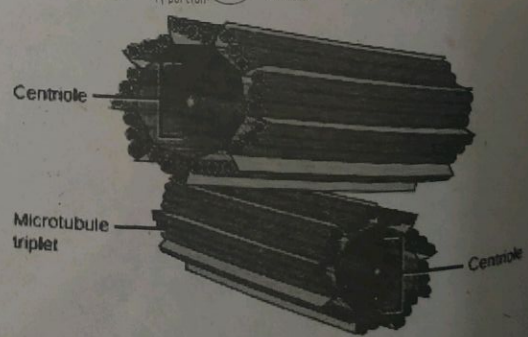


- They were first discovered by Golgi in 1898.
- Golgi apparatus in plants is called ***Dictyosomes*** which are used in construction of cell wall.
- Golgi apparatus is a stack of flattened, membrane bounded sacs called cisternae.
- Golgi complex is a system of interconnected tubules around the central stacks. The cisternae together with associated vesicles are called Golgi complex.
- Vesicles budded off from smooth endoplasmic reticulum are fused together to from cisternae of Golgi apparatus.
- Golgi apparatus has two faces i.e. forming face and maturing face.
- Forming face is outer convex surface and maturing face is inner concave surface.
- Secretory granules are pinched off from maturing surface.
- They are concerned with the cell secretion.
- Passage of secretions is: Ribosome $\rightarrow$ER$\rightarrow$Golgi App$\rightarrow$Out of body.

MITOCHONDRIA

- They are also called power house of the cell.
- They are self-replicating organelles.
- Their size and number varies depending on the physiological activity of the cell.
- They also contain DNA and ribosome, thus some proteins they also synthesize in them.
- When seen under electron microscope, then it shows that they are bounded by two membranes, a smooth outer membrane and an inner one forming infoldings (cristae) in mitochondrial matrix and they show complex morphology.
- The inner surface of cristae in the mitochondrial matrix contains small knob like structure i.e. F_1 particles.
- Mitochondrial matrix contains enzymes, co – enzymes and organic and inorganic salts.
- They manufacture and supply of energy in the cell.
- Enzyme in mitochondrial matrix help in metabolic processes like. Krebs cycle, aerobic respiration and fatty acid metabolism. These processes extract energy from the organic food and convert them into ATP. An energy rich compound. Which provides energy to the cell on demand.





- The spent energy in the form of ADP is regenerated by mitochondria into ATP.
- In plants, it is also involved in photorespiration.

CENTRIOLES

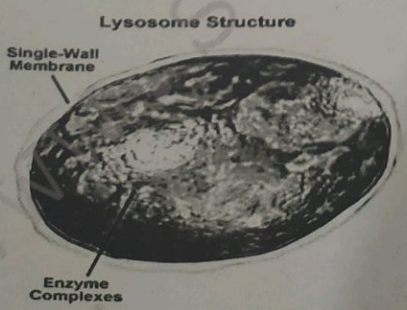
- They are present in animal cells, cells of microorganisms and in lower plants.
- They are absent in higher plants and fungi.
- They usually occur in pairs at right angle to each other near one pole of nucleus.
- Cross section shows an array of ***9 microtubules***, each composed of ***3 tubules*** called triplet of tubule.
- Total number of tubules in a centriole is **27**.
- Before cell division, they duplicate and one pair move to opposite poles developing spindle fibers.
- They decide location of furrowing during cell division.
- They also help in the formation of cilia.

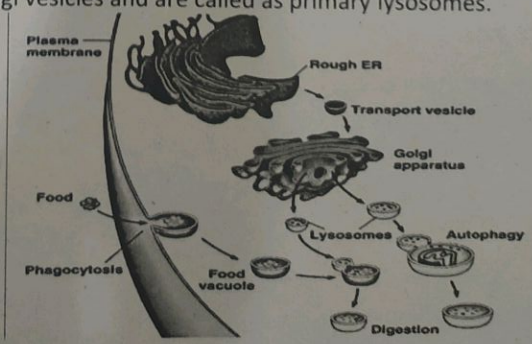
RIBOSOMES

- Palade was the first person to study ribosome in 1955.
- Ribosomes are assembled in the nucleolus from where they are transported to the cytoplasm through nuclear pores.
- Ribosomes are ribonucleo-proteins i.e. consist of RNA and proteins.
- They exist in two forms, either dispersed in the cytoplasm or attached with rough endoplasmic reticulum (RER) as tiny granules.
- Eukaryotic ribosomes consist of two subunits, larger subunit sediments at 60S while the smaller at 40S (S = Svedberg unit used in ultracentrifugation, signifies sedimentation rate.)
- Both attach to from 80S particles, which are controlled by Mg^{2+} ions.
- Ribosomes are attached to 5' end of mRNA through smaller subunits.
- A group of ribosomes attached to mRNA is known as **polysome.**

LYSOSOMES

- These were isolated as a separate component for the first time by De Duve (1949).
- Any foreign object that gains entry into the cell is immediately engulfed by the lysosome and is completely broken into simple digestible pieces. The process is known as phagocytosis (eating process of a cell). They are most abundant in those animal cells which exhibit phagocytic activity.
- They are bounded by a single membrane and are simple sacs rich in acid phosphatases and several other hydrolytic enzymes.
- These enzymes are synthesized on RER and are further processed in the Golgi apparatus. The processed enzymes are budded off as Golgi vesicles and are called as primary lysosomes.





- Lysosomes protect the cells from invading organisms or any other foreign object, (food) which are engulfed in the cell as phagocytic vacuoles. These fuse with primary lysosomes to form digestive

vacuole (secondary lysosome) in which various lysosomal enzymes digest various components of the vacuole.

Sometimes under abnormal circumstances, e.g. starvation, or as a normal physiological process the parts of the cell are engulfed by primary lysosomes and digested to generate energy.

The lysosomes which eat parts of their own cell are known as autophagosomes. The digestive vacuoles and auto phagosomes are also known as secondary Lysosomes.

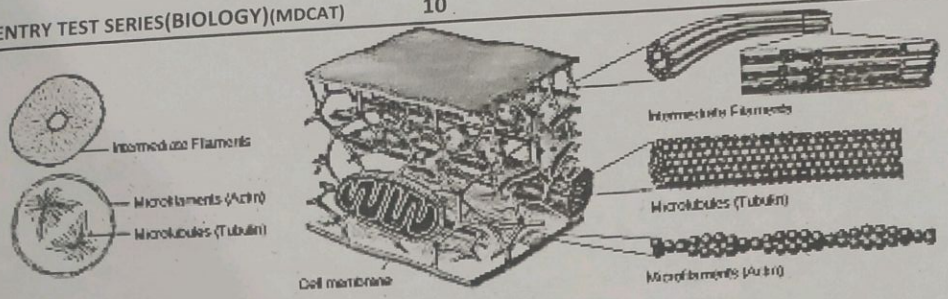
They are also involved in the autophagy (self-eating). During this process some old, worn out parts of cell, such as old mitochondria are digested. In this way, materials of cell may be recycled and cell may be renewed.

Their enzymes can also result in degeneration of cell, as may occur during some developmental processes. Lysosomes also release enzymes for extra cellular digestion.

- Several congenital diseases have been found to be due to accumulation within the cell of substances such as glycogen or various glycolipids. These are also called storage diseases and are produced by a mutation that effect one of the lysosomal enzymes involved in the catabolism of a certain substance.
- **For example, in glycogenosis type I disease**, the liver and muscle appear filled with glycogen within membrane bound organelles. In this disease, an enzyme that degrades glycogen to glucose, is absent.
- About twenty such diseases are known these days, which are because of absence of a particular enzyme.
- **Tay-Sach's disease** is because of absence of an enzyme that is involved in the catabolism of lipids. Accumulation of lipids in brain cells lead to mental retardation and even death.

CYTOSKELETON

- Cytosol contains cytoskeletal fabric formed of **microtubules, microfilaments** and **intermediate filaments.**
- The main proteins that are present in cytoskeleton are tubulin (in microtubules), actin, myosin, tropomyosin and troponin (in microfilaments).
- **Microtubules (25 nm)** are long, unbranched, slender tubulin protein structures. One very important function of microtubules is their role in the assembly and disassembly of the spindle structure during mitosis. Several cell organelles are derived from special assemblies of microtubules, for examples cilia, flagella, basal bodies and centrioles.
- **Microfilaments (7 nm)** are considerably more slender cylinders made up of contractile actin protein, linked to the inner face of the plasma membrane. They are involved in internal cell motion. The movement of cyclosis and amoeboid movements are because of microfilaments,
- **Intermediate filaments (8-10 nm)** have diameter in between those of microtubules & microfilaments. They play role in the maintenance of cell shape, involved in determination of cell shape and integration of cellular compartments.



VACOULES

- Although vacuoles are present both in animal and plant cells.
- They are particularly large and abundant in plant cells often occupying a major portion of the cell volume and forcing the remaining intracellular structures into a thin peripheral layer.
- These vacuoles are bounded by a single membrane and are formed by the coalescence of smaller vacuoles during the plant's growth and development.

Functions

- Vacuoles serve to expand the plant cell without diluting its cytoplasm.
- **Act as sites for the storage of water and cell products or metabolic intermediates.**
- **The – plant vacuole is the major contributor to the turgor that provides support for the individual plant cell and contributes to the rigidity of the leaves and younger parts of the plants.**

CHLOROPLAST

- In photosynthetic plant cells, there are membrane bound structures containing a green pigment, called chloroplasts.
- **Chloroplasts are self – replicating organelles.**

Chlorophyll

- The green pigment is an organic compound, chlorophyll, which helps the cell to absorb light energy and utilize it to manufacture food.
- **Chlorophyll molecule resembles the haem group of haemoglobin, a protein used in the transport of oxygen. The main difference between these two molecules is that chlorophyll has Mg^{++} while haem has Fe^{++} as the central atom.**
- **Chloroplasts vary in their shape and size with a diameter of about 4 – 6µm.**
- **Under light microscope,** they appear to be heterogeneous structures with small granules known as **grana** embedded in the matrix.
- **Under electron microscope**, a chloroplast shows three main components, the **envelope,** the **stroma** and the **thylakoid**. The **envelope** is formed by a double membrane, while stroma covers most of the volume of the chloroplast.
- **Stroma** is a fluid which surrounds the thylakoids. **It contains proteins, some ribosomes and a small circular DNA. It is in this part of the chloroplast where CO_2 is fixed to manufacture sugars. Some proteins are also synthesized in this part.**
- **Thylakoids** are the flattened vesicles which arrange themselves to form grana and intergrana.

- **A granum** appears to be a pile of thylakoids stacked on each other like coins. On an average, there are **50** or more thylakoids piled to form one granum.
- On the layers of thylakoids chlorophyll molecules are arranged and that is why granum appears to be green.
- Each granum is inter-connected with others by the non – green part called **intergranum.**
- **Membranes of the grana are sites where sun light energy is trapped and where ATP is formed.**

Light and Electron Microscope (Resolution and Magnification)

❖ **Resolution:** The shortest distance between two points on a specimen that can still be distinguished by the observer as separate entities.

❖ **Magnification:** A measure of the ability of a lens or other optical instrument to magnify, expressed as the ratio of the size of the image to that of the object.

- **The human naked eye can differentiate between two points, which are at least 1.0 mm apart. This is known as resolution of the eye.**
- This resolution can be increased with the aid of lenses.
- A compound microscope is a typical laboratory microscope with at least different magnification powers. The typical ocular lenses could be 5X and 10X, but other also exist. Likewise different types of objective lenses viz. 20X, 40X, 100X etc. exist.

Determination of magnification power

- The magnification power of microscope is determined by multiplying X values of ocular lens and X value of objective lense. Therefore, a microscope with 10X ocular lens and 40X objective lense will have (10X40=400X) 400X magnifying power. The resolution will, however, remain the same, which is 500X that of the naked eye.

Difference between Compound Microscope and Electron Microscope

Features	COMPOUND MICROSCOPE	ELECTRON MICROSCOPE
Source of illumination	Visible light	Beam of electron
Magnification power	500X of naked eye. Lower magnification than an electron microscope	2,50,000X of naked eye. Higher Magnification
Resolution	2µm Low resolution	2–4 Å High resolution
Lenses	Glass lens	Electromagnetics
Specimen	Both live and dead specimen can be seen	Only dead and the dried specimen can be seen
Specimen observation	Larger than 200 nm	Smaller than 200 nm
Image observation	By eyepiece	By screen
	Open (Atmosphere)	Vaccum

Difference between TEM and SEM

Features	TEM	SEM
Source of illumination	Beam of electron	Beam of electron
Magnification power	1,000,000X (1 million)	15 × to 200,000X
Resolution	200 nm	5 nm
Image observation	By screen	By screen

Beam of electron	Transmitted through specimen	Reflected
Specimen thickness	Thin section of specimen	Scan the surface of specimen
Field view	Lesser (field view)	Greater (Field view)
Observation	Cell + Component (internal structure)	Detail outer surface of specimen

MCQs of CELL BIOLOGY

1. **Most distinctive feature of prokaryotic cell is:**
   A) Flagella
   B) Lack of Ribosomes
   C) Kind of Cell wall
   D) Cytoplasm
2. **The human eye can differentiated between two points , which are at least ..... apart.**
   A) 1 nm B) 1mm C) 1µm D) 1 À
3. **Which one of the following statement is true about plastids**
   A) They are surrounding by single membrane
   B) They are found in all organism
   C) Its not autonomous organelle
   D) They contain DNA and ribosome
4. **In unit membrane model, the part of phospholipids attached to globular protein is:**
   A) Hydrophilic B) Hydrophobic C) Hydrostatic D) Lipid soluble
5. **Single membrane bounded organelle is:**
   A) Lysosome B) Nucleus C) Ribosome D) Mitochondrion
6. **Which have some difficulty in crossing cell membrane?**
   A) Steroids B) Gas C) Glucose D) Ions
7. **Lysosome is found in:**
   A) Plant cell only
   B) Animal cells only
   C) Both cells
   D) Lipid rich seeds
8. **Proteins are converted into glycoproteins by:**
   A) Nucleolus
   B) Mitochondria
   C) Golgi apparatus
   D) Endoplasmic Reticulum
9. **They are involved in internal cell motion:**
   A) Microtubules
   B) Microfilaments
   C) Intermediate filaments
   D) Flagella
10. **They are organelles of symbiotic origin:**
    A) Nucleus & mitochondria
    B) Golgi & E.R
    C) Chloroplast & mitochondria
    D) Cilia
11. **Absence of enzymes that are involved in the catabolism of lipids cause:**
    A) Glycogenosis I B) Glycogenosis II C) TaySach's disease D) Lipogenesis
12. **There are _____ kinds of ribosomes subunits found in living things**
    A) 2 B) 3 C) 4 D) 5
13. **Nuclear outer membrane is continuous with**
    A) E.R. B) Golgi bodies C) Centrioles D) Both A& B
14. **The exact replica of chromosome is:**
    A) Chromatid B) Chromatin C) Centromere D) Plasmid
15. **Nucleus is stained with**
    A) Basic dyes B) Neutral dyes C) Acidic dyes D) None of these
16. **Mitochondria does not contains:**
    A) Cisternae B) Eukaryotic C) Ribosomes D) All of these
17. **Ribosome factory is:**
    A) RER B) SER C) Nucleus D) Nucleolus
18. **In muscle cells which of these conducts impulses?**

A) Nucleus B) Cytoplasm C) Golgi bodies D) Smooth ER

19. **These are stacks of flattened membrane bounded vesicles:**
A) Lysosome C) Cisternae
B) Endoplasmic reticulum D) Nucleus

20. **In pancreas, granules containing enzymes are secreted by?**
A) Golgi bodies C) Ribosome
B) Endoplasmic Reticulum D) All of these

21. **Two centrioles are located at _____ degree angle to each other.**
A) 90 B) 45 C) 60 D) 75

22. **Large and central vacuole in plant is responsible is**
A) Photosynthesis C) Support to the leaves
B) Starch storage D) Ion crystal storage

23. **The spent energy is in the form of:**
A) ATP B) ADP C) NADPH D) All of these

24. **It controls life and activities of cell:**
A) Nucleus B) Mitochondria C) Chloroplast D) ER

25. **E.R is absent in?**
A) Animal cells B) Prokaryotes C) Plant cells D) Protists and fungi

26. **Element required for bringing about union of ribosome sub unit is?**
A) Ca^{2+} B) Mg^{2+} C) Fe^{2+} D) Cl^-

27. **Nucleolous contains?**
A) Genetic instructions C) Protein synthesis machinery
B) Ribosome assembly line D) Enzymes for polysaccharides formation

28. **Taking in solid food particles or foreign bodies through cell membrane is?**
A) Phagocytosis B) Pinocytosis C) Endocytosis D) Osmosis

29. **The functional unit of golgi apparatus is?**
A) Thylakoids B) Oxysomes C) Cristae D) Cisternae

30. **Centriole/centrosome takes part in?**
A) Nucleolus formation C) Cell plate formation
B) Start of cell division D) Spindle formation

31. **Which substance can cross plasma membrane more easily?**
A) Ions B) Proteins C) Lipid soluble D) Starch

32. **Which is the correct for plant cell?**
A) Cell membrane is most outer C) Cell wall beneath plasma membrane
B) Cell wall outer the cell membrane D) Nuclear membrane is the outer most

33. **How many of the following are membrane bounded organelles?**
Mitochondria,centrioles,nucleolus, nucleus, chloroplast, ribosomes,
A) 2 B) 4 C) 3 D) 5

34. **Which is of the following is present both in prokaryotic and eukaryotic cell?**
A) Nucleus B) Ribosomes C) Bacteriochlorophyll D) Mitochondria

35. **Which is the similarity between animal cell and bacterial cell?**
A) Both have cell wall C) Both have cell membrane
B) Both have mitochondrias D) Both have nucleus

36. **The similarity in animal and bacterial cell?**

A) Both have storage in the form of glycogen
B) Both have storage in the form of cellulose
C) Both have storage in the form of lipids
D) Both a and c are correct

37. Light reaction take place in
A) Thylakoid membrane
B) Thylakoid space
C) Stroma
D) Granum

38. Which of the following are not the contents of vacuole?
A) Water
B) Sap
C) Enzymes
D) Excretory products

39. The correct statement is?
A) All prokaryotic cells are diploid
B) All prokaryotic cells are haploid
C) All prokaryotic cells are triploid
D) All prokaryotic cells can be haploid and diploid

40. The name of a process expelling particles from a cell is
A) Exocytosis. B) Phagocytosis. C) Endocytosis. D) Reverse osmosis

Answers:

1.	C	2.	B	3.	D	4.	A	5.	A	6.	C	7.	C	8.	C	9.	B	10.	C
11.	C	12.	A	13.	A	14.	A	15.	A	16.	D	17.	D	18.	D	19.	C	20.	A
21.	A	22.	D	23.	A	24.	A	25.	B	26.	B	27.	C	28.	A	29.	D	30.	D
31	C	32	B	33	B	34	B	35	C	36	D	37	A	38	C	39	D	40	A

ASSESS YOURSELF:

1. **The intake of liquid material across the cell membrane is:**
   A) Phagocytosis B) Endocytosis C) Pinocytosis D) Exocytosis
2. **Which one of the following is the site of oxidative phosphorylation in mitochondria**
   A) Cristae B) Matrix C) Outer membrane D) Ribosomes
3. **Organelle involved in the synthesis of ATP is :**
   A) Ribosomes B) Mitochondria C) Nucleus D) Centriole
4. **Peptidoglycan or murein is special or distinctive feature of cell wall in :**
   A) Algae B) Fungi C) Bacteria D) Plants
5. **In mitochondria small knob like structure called F_1 particles are found in:**
   A) Outer membrane C) Inner membrane
   B) Outer compartment D) Inner compartment
6. **During animal cell division the spindle fibers are formed from:**
   A) Mitochondria B) Centrioles C) Ribosomes D) Lysosomes
7. **Which component of the cell is concerned with cell secretions?**
   A) Plasma membrane B) Golgi complex C) Cytoskeleton D) Mitochondria
8. **The___model of plasma membrane suggests that proteins are embedded in lipid bilayer:**
   A) Unit membrane B) Fluid mosaic C) Permeable D) Ultracentrifuge
9. **The function of nucleolus is to make:**
   A) rDNA B) Ribosomes C) RNA D) Chromosomes
10. **Lipid metabolism is the function of :**
    A) Mitochondria C) RER
    B) Sarcoplasmic reticulum D) SER
11. **The enzymes of lysosomes are synthesized on:**
    A) RER B) SER C) Chloroplast D) Golgi apparatus
12. **Centrioles are made up of___microtubules:**
    A) 9 B) 27 C) 3 D) 12
13. **Which of the following structures is absent in higher plants and found in animal cells:**
    A) Centriole B) Cytoskeleton C) Mitochondria D) Cytoplasm
14. **The soluble part of cytoplasm or fluid that remains when all organelles are removed is known as:**
    A) Solution B) Gelatin material C) Cytoskeleton D) Cytosol
15. **The process by which unwanted structures with in the cell are engulfed and digested with in the lysosome is known as:**
    A) Endocytosis B) Exocytosis C) Hydrolysis D) Autophagy
16. **Plastids are only found in the :**
    A) Animals and plants B) Animals C) Plants D) Viruses
17. **Plasma membrane is chemically composed of :**
    A) Phospholipids only C) Lipids and carbohydrates
    B) Lipids and proteins D) Glycoproteins
18. **Endoplasmic reticulum consists a system of flattened membrane bounded sacs which are named as :**
    A) Cristae B) Marks C) Cisternae D) Tubules
19. **Lipids synthesis / metabolism takes place in which of the following organelle?**

A) Mitochondria
B) Vacuoles
C) Rough endoplasmic reticulum
D) Smooth endoplasmic reticulum

20. What is the main arena of cellular activities in eukaryotic cells?
A) Nucleus B) Cytoplasm C) Plasma membrane D) Ribosomes

21. Glycoproteins are known to play an important role in cell recognition, the specific of this recognition is provided largely by
A) Carbohydrate portion of these glycoproteins
B) Protein portion of these glycoproteins
C) Both carbohydrates and protein component of these glycoprotein
D) Lipid portion of glycoproteins

22. When a glycoprotein is being synthesized for secretion from a cell, which route is it most likely to take?
A) Golgi apparatus → rough endoplasmic reticulum → smooth endoplasmic reticulum
B) Rough endoplasmic reticulum → Golgi apparatus → smooth endoplasmic reticulum
C) Rough endoplasmic reticulum → smooth endoplasmic reticulum → Golgi apparatus
D) Smooth endoplasmic reticulum → rough endoplasmic reticulum → Golgi apparatus

23. If ribosomes of a cell are destroyed then
A) Respiration will not take place
B) Fats will not be stored
C) Proteins will not be formed
D) Carbon assimilation will not occur

24. Granular endoplasmic reticulum is mainly concerned with
A) Proteolysis
B) Peptide bond formation
C) Glycosidic bond formation
D) Fatty acid and cholesterol synthesis

25. Golgi apparatus is absent in
A) Liver cells B) Higher plants C) Blue green algae D) Yeast

26. Which of the following is organelle of an organelle?
A) Ribosome B) Mitochondria C) Chloroplast D) Endoplasmic reticulum

27. The fluid mosaic model describes membranes as having
A) A set of protein channels separated by phospholipids
B) A bilayer of phospholipids in which specialized proteins are embedded.
C) A sugar-phosphate backbone that interconnects specific transport molecules.
D) Two sheets of protein with a layer of phospholipids sandwiched between them

28. Which of the following represents active transport .
A) Simple diffusion
B) Concentration gradient.
C) Filtration.
D) Solute pumps

29. Which one has metabolically more active plasma membrane
A) Plant cell B) Animal cell C) Bacteria D) Virus

30. Which is NOT a characteristic of mitochondria?
A) A mitochondrion has two membranes.
B) Mitochondria are the site of cellular respiration.
C) Mitochondria are found in prokaryotic and eukaryotic cells.
D) Mitochondria contain DNA and ribosomes.

31. Pinocytosis and phagocytosis are accomplished by the
A) Nucleus. B) Mitochondria. C) Cell membrane. D) Endoplasmic reticulum

32. The microtubules of the cytoskeletons are composed of the protein called:
A) Tubulin B) Actin C) Myosin D) Tropomyosin

33. Golgi complex is concerned with:
A) Cell eating B) Power house of cell C) Cell development D) Cell secretions

34. Prokaryotes are characterized by all of the following structures EXCEPT
A) A nucleoid. B) Granum C) Mesosomes D) Plasmid

35. Which one of the following eukaryotic cell structures does not contain DNA?
A) A nucleus
B) A mitochondrion
C) Endoplasmic reticulum
D) A chloroplast

36. Phragmoplasts are formed by
A) ER B) Mitochondria C) Golgi bodies D) Nucleus

37. Which is true for bacterial cells?
A) Smaller ribosomal subunit 50Sv
B) Larger ribosomal subunit 60Sv
C) Larger ribosomal subunit 50Sv
D) Smaller ribosomal subunit 40Sv

38. Precursors of ribosomal subunits are found in_____ of Nucleolus:
A) Centriole B) Central area C) Peripheral area D) Both A + B

39. Size of ribosomes in endosymbiotic origin organelles
A) 50S B) 60S C) 70S D) 80S

40. The magnification power of a light microscope is determined by
A) X value of ocular lens
B) X value of objective lens
C) X value of eye piece lens
D) X value of eye piece lens and X value of objective lens

CHAPTER 02

BIOLOGICAL MOLECLES

COURSE CONTENT

- Carbohydrates: Monosaccharides, Disaccharides and Polysaccharides (Starch, Glycogen & Cellulose)
- Lipids: Triglycerides, Phospholipids and their functions.
- Proteins: Amino Acids & Peptide bond formation, Structures of Proteins (primary, secondary, tertiary and quaternary structures) and Globular & Fibrous Proteins
- Nucleic acids: DNA, RNA and Types of RNA
- Water: Heat of vaporization, Specific Heat Capacity and Solvent Action
- Enzyme: Definition, Characteristics of, Mechanism of Enzyme Action Enzymes (Lock & key model and Induced fit model), Factors affecting the rate of Enzyme Action, Inhibitors

IMPORTANCE OF WATER

- Water is the medium of life. It is the most abundant compound in all organisms.
- It varies from 65 to 89 percent in different organisms. Human tissues contain about 20 per cent water in bone cells and 85 per cent in brain cells.
- Almost all reactions of a cell occur in the presence of water. It also takes part in many biochemical reactions such as hydrolysis of macromolecules. It is also used as a raw material in photosynthesis.

Solvent properties

- Water is an excellent solvent for polar substances due to its polarity.
- **Ionic substances** when dissolved in water, dissociate into positive and negative ions.
- **Non – ionic substances** having charged groups in their molecules are dispersed in water. When in solution, ions and molecules move randomly and are in a more favorable state to react with other molecules and ions.
- **Nonpolar organic molecules**, such as fats, are insoluble in water and help to maintain membranes which make compartments in the cell.

Heat capacity

- The specific heat capacity of water – **the number of calories required to raise the temperature of 1g of water from 15 to 16°C is 1.0.** This is because much of the energy is used to break hydrogen bonds.
- Water thus works as **temperature stabilizer** for organisms in the environment and hence **protects living material against sudden thermal changes.**

Heat of vaporization

- Water absorbs much heat as it changes from liquid to gas.
- **Heat of vaporization is expressed as calories absorbed per gram vaporized. The specific heat of vaporization of water is 574 Kcal/kg,** which plays an important role in the regulation of heat produced by oxidation.

- It also provides cooling effect to plants when water is transpired, or to animals when water is perspired.
- **Evaporation of only ml out of one liter of water lowers the temperature of the remaining 998 ml by 1°C.**

Ionization of water

- The water molecules ionize to form H^+ and OH^- ions:

$$H_2O \rightleftharpoons H^+ + OH^-$$

- **At 25°C the concentration of each of H^+ and OH^- ions in pure water is about 10^{-7} mole/liter.**

Protection

- Water is effective lubricant that provides protection against damage resulting from friction. For example, tears protect the surface of eye from the rubbing of eyelids, water also forms a fluid cushion around organs that helps to protect them from trauma.

CARBOHYDRATES

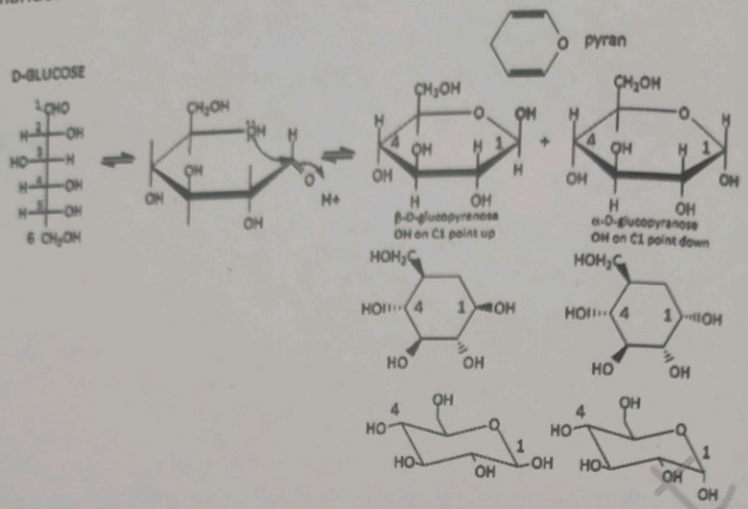
- Carbohydrates literally mean ***"hydrated carbons"***, also called "Saccharides" (derived from Greek word Sakcharon meaning sugar)
- They are composed of C, H, and O.
- ***Chemically*** they are ***defined*** as "polyhydroxy aldehydes or ketones or complex substances which on hydrolysis yield polyhydroxy aldehyde or ketone subunits."
- Their ***general formula*** is $C_x (H_2O)_y$.
- Simple carbohydrates are the main ***source of energy*** in cell.
- Some carbohydrates are the main ***constituents of cell walls*** in plants and microorganisms.
- Examples are cellulose, cotton and paper, starches present in cereals, root tubers, cane sugar and milk sugar.
- Their ***main sources are*** green plants, which produce them by photosynthesis. Even all the other compounds of plants are synthesized from carbohydrates.
- Conjugated molecules of carbohydrates are glycoproteins and glycolilpids.

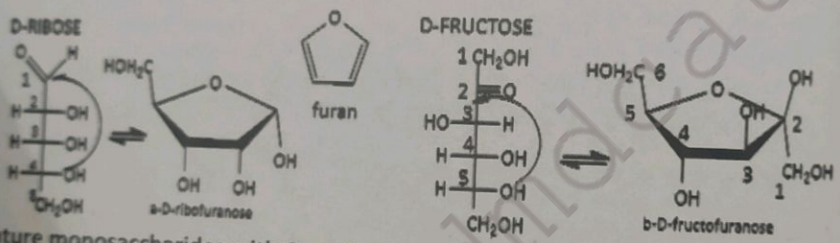
Major Groups of Carbohydrates

Feature	Monosaccharides	Oligosaccharides	Polysaccharides
Common Name	Simple sugars	Complex sugars	Most complex sugars
Taste	Sweet	Less sweet	Tasteless
Solubility in water	Easily soluble in water	Less soluble in water	Sparingly soluble in water
Hydrolysis	Can't be hydrolyzed into simpler sugar	Can be hydrolyzed	Can be hydrolyzed
General Formula	$(CH_2O)n$	.....	$Cx(H_2O)y$
Classification	• On base of functional group e.g. Aldo and keto sugars. • On base of number of carbon atoms e.g. trioses (3C), tetroses (4C),	On base of monosaccharides released during hydrolysis e.g. disaccharides, Trisaccharides etc.	On base of structural complexity & relation e.g. starch, glycogen, cellulose, dextrin, agar, pectin and chitin.

	pentoses (5C) etc.		

Monosaccharides





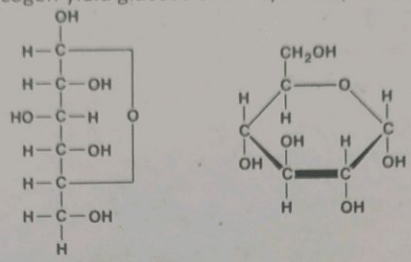
In nature monosaccharides with *3 – 7 C atoms* are found.

ATOMS	TYPE	FORMULA	Aldo form	Keto form	EXAMPLES
3 C	Trioses	$C_3H_6O_3$	Glyceraldehyde	Dihydroxyacetone	Glyceraldehyde, Dihydroxyacetone
4 C	Tetroses	$C_4H_8O_4$	Erythrose	Erythrulose	Rare, found in some bacteria
5 C	Pentoses	$C_5H_{10}O_5$	Ribose	Ribulose	Ribose found in RNA
6 C	Hexoses	$C_6H_{12}O_6$	Glucose	Fructose	Glucose, fructose
7 C	Heptose	$C_7H_{14}O_7$	Glucoheptose	Sedoheptulose	Heptulose

- Most monosaccharides form a ***ring structure*** in solution.
- Ribose forms a five cornered ring called ***ribofuranose*** in solution.
- Glucose forms six cornered ring called ***glucopyranose*** in solution.

Glucose

- Naturally produced in green plants which take carbon dioxide from air and H_2O from soil to synthesize glucose.
- Synthesis of ***10g of glucose*** requires ***717.6 Kcal*** of solar energy, which in turn is stored in glucose molecule and becomes available in all organisms when it is oxidized in the body.
- Our ***blood*** contains ***0.08%*** glucose.
- Starch, cellulose and glycogen yield glucose on complete hydrolysis.

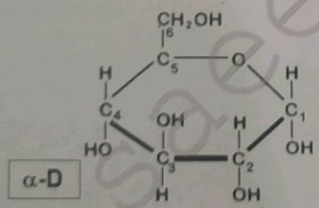


Glucose

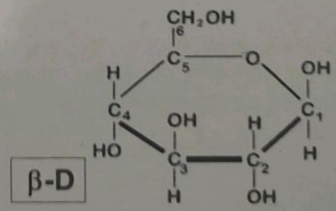
Oligosaccharides

- Those oligosaccharides which yield two monosaccharides on hydrolysis are called ***disaccharides*** and those yielding three are called ***trisaccharides***.
- The covalent bond between two monosaccharides is called ***glycosidic bond***.
- ***Maltose, sucrose, and lactose*** all are disaccharides.
- **Example of Trisaccharides are maltotriose and raffinose**
- ***Sucrose*** (cane sugar) on hydrolysis releases glucose and fructose (both monosaccharides and reducing sugars).

Glucose + Glucose ⟶ Maltose (1 → 4)
Glucose + Galactose ⟶ Lactose (1 → 4)
Glucose + Fructose ⟶ Sucrose (1 → 2)



α-D



β-D

Reducing & Non-Reducing Sugars

- Sugars which give positive result on Benedict or Fehling Test are called reducing sugars. These act as reducing agents. They have free aldehyde or free ketone group. All monosaccharides, lactose and maltose are reducing sugars.

Polysaccharides

- They are formed by several monosaccharide units linked by glycosidic bonds.
- Starches, glycogen, cellulose, dextrin, agar, pectin and chitin all are polysaccharides.

Major Groups of Carbohydrates

Feature	Starch	Glycogen	Cellulose

Organism	Plants, Green Algae	Animal, Fungi, prokaryotes	Plants, Green Algae
Location	Fruits, grains, seeds, tubers	Liver & muscles	Main constituent of cell walls
Main function	Main source of carbohydrates for animals	Chief storage form in animals	Main constituent of cell wall of plants.
Result of hydrolysis	Glucose molecules	Glucose molecules	Glucose molecules
Solubility	Amylose soluble in hot water (amylopectin are not)	Insoluble in water	Highly insoluble in water
Iodine test	Blue colour with iodine	Red colour with iodine	Gives no colour change with iodine

Monosacchanides
- Source → Fruits & Vegetables
- Function → Provide Energy , Converted to Glycogen for storage
- Types → Glucose, fructose, galactose

Disaccharide
- Source → Sugar cane, beetroot, milk
- Function → Excess is stored as fats
- Types → Sucrose, maltose, lactose

Polysaccharide
- Source → Used in synthesis of many complex molecules.
- Function → Rice, cereal, bread
- Types → Starch, cellulose, glycogen

Starches

There are two types of starches i.e. amylose & amylopectin.

FEATURE	AMYLOSE	AMYLOPECTIN
Structure	Unbranched chain	Branched chain
Solubility	Soluble in hot water	Insoluble in hot or cold water
Glucose linkage	1, 4 glycosidic linkage	1, 4 & 1, 6 glycosidic linkage

Cellulose

- Cotton is a pure form of cellulose.

MCQs of CARBOHYDRATES

1. **The molecular formula of maltose is:**
   A) $C_{12}H_{22}O_{11}$ B) $C_{12}H_{24}O_{12}$ C) $C_{12}H_{22}O_{12}$ D) $C_6H_{22}O_{11}$
2. **Polysaccharides are (STARS) :**
   A) Insoluble in hot Water
   B) Sparingly soluble in hot water
   C) Sparingly soluble in cold water
   D) Insoluble in hot water
3. **Glycogen is stored in:**
   A) Liver B) Spleen C) W.B.C. D) Skin Cells
4. **Percent amount of carbohydrates in a Bacterial cell:**
   A) 4 B) 3 C) 2 D) 1
5. **Which bond provides stability to complex carbohydrates:**
   A) N – C B) C – O – C C) P – O – C D) C – O – N
6. **What kind of Glycosidic linkage is found in sucrose?**
   A) 1,6 B) 1,4 C) 2,6 D) 1,2
7. **Blood contains _____ percent glucose:**
   A) 0.8% B) 0.08% C) 0.06% D) 6%
8. **717.6 K cal of solar energy is required for the synthesis of_____ glucose:**
   A) 1gm B) 5 gm C) 10 gm D) 20 gm
9. **Glycosidic bond is a:**
   A) Covalent
   B) Covalent coordinate
   C) Ionic
   D) Metalic Covalent
10. **The colour that cellulose gives with iodine is:**
    A) Blue B) Red C) Violet D) No color
11. **Main component of fungus cell wall is:**
    A) Peptidoglycan B) Chitin C) Lignin D) Cellulose
12. **Cotton is the pure form of:**
    A) Cellulose B) Glycogen C) Wax D) Protein
13. **It gives blue color with iodine:**
    A) Glycogen B) Amylose C) Chitin D) Amylopectin
14. **They are primary product of photosynthesis:**
    A) Carbohydrates B) Proteins C) Lipids D) All
15. **Cellulose is digested by which of these?**
    A) Plants B) Humans C) Lion D) Herbivores
16. **Which of the following does not contain amino acids?**
    A) Carbonic anhydrase
    B) Glycogen
    C) Haemoglobin
    D) Insulin
17. **The inference of which of the following is colourless with iodine solution?**
    A) Starch B) Glycogen C) Cellulose D) Amylose
18. **Sucrose is**
    A) Reducing sugar
    B) Non-reducing sugar
    C) Monosaccharide
    D) Reducing, disaccharide
19. **Select the one which show characteristics like polymer of beta glucose, 1,4-glycosidic linkage?**
    A) Glycogen B) Amylopectin C) Cellulose D) Amylose

20. **The most abundant molecule in the bodies of all the organisms is the:**
A) Protein B) Lipid C) Water D) Carbohydrates:

21. **Ionic substances when dissolved in water, dissociate into:**
A) Positive ions C) Positive and negative ions
B) Negative ions D) Neutral ions

22. **The number of OH groups in glucose is:**
A) 4 B) 5 C) 6 D) 7

23. **In glycogen, which kind of linkage is found between adjacent glucose molecules?**
A) 1,4 B) 1,6 C) 1,2 D) Both A and B

24. **Which of the following is a reducing sugar?**
A) Galactose B) Gluconic acid C) Sucrose D) Chitin

25. **Which one are intermediates in respiration and photosynthesis both?**
A) Ribose and heptolose C) Glucose and galactose
B) Glyceraldehydes and dihydroxyacetone D) Fructose and ribulose

26. **Monosaccharide's are major components of:**
A) DNA, ATP, Ribulose bisphosphate and Cysteine
B) DNA, NAD and Insulin
C) DNA, NADP, ATP and Ribulose bisphosphate
D) DNA, RNA and Myosin

27. **$C_3H_6O_3$ is the chemical formula of:**
A) Glyceraldehyde B) Dihydroxyacetone C) Aldo-sugar D) Triose

28. **These are rare in nature and occur in some bacteria:**
A) Glucose B) Ribulose C) Erythrose D) Ribose

29. **Our blood normally contains:**
A) 0.08% glucose B) 0.8% glucose C) 0.008% glucose D) 8.0% glucose

30. **Both glucose and fructose are hexoses, glucose makes a _____ whereas fructose make a _____ in a solution, respectively:**
A) Pyran, Pyran B) Furan, Furan C) Furan, pyran D) Pyran, Furan

31. **Amylopectin is insoluble in:**
A) Hot water C) Hot and cold water both
B) Cold water D) Lukewarm water

32. **A glucopyranose having hydroxyl group –OH, on carbon atom 1, below the ring is called:**
A) α glucose B) β glucose C) D glucose D) L glucose

33. **Synthesis of polysaccharides from monosaccharides is called:**
A) Condensation synthesis C) Hydration synthesis
B) Hydrolysis D) Condensation or dehydration synthesis

34. **Many animals provide energy to their young ones in the form of:**
A) Sucrose B) Lactose C) Maltose D) Glycogen

35. **These are the primary products of photosynthesis:**
A) Proteins B) Nucleic acids C) Carbohydrates D) Lipids

36. **How many carbon atoms are kept outside the ring in fructose:**
A) 01 B) 02 C) 03 D) 04

37. **Amylose starches have unbranched chains of_____and are_____in hot water:**
A) Glucose, soluble B) Glucose, insoluble C) Ribose, soluble D) Ribose, insoluble

38. **Glycogen is found in:**

A) Liver cells
B) Muscle cells
C) Liver and muscle cells
D) All animals cells

39. The specific heat of vaporization of water is _____ Kcal/kg:

A) 374
B) 474
C) 574
D) 674

40. These are rare in nature and occur in some bacteria:

A) Glucose
B) Ribulose
C) Erythrose
D) Ribose

Answers :

1.	B	2.	B	3.	A	4.	B	5.	B	6.	D	7	B	8.	B	9.	A	10.	D
11	B	12	A	13	A	14	A	15	D	16	B	17	C	18	B	19	C	20	C
21	C	22	B	23	D	24	A	25	B	26	C	27	D	28	C	29	A	30	D
31	C	32	A	33	D	34	B	35	C	36	B	37	A	38	D	39	C	40	C

PROTEINS

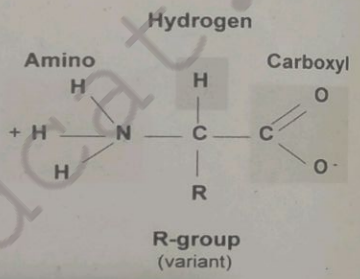
- They are the ***most abundant organic compounds*** found in cells and comprising over 50% of their total dry weight.
- Proteins are polymers of amino acids, compounds containing ***C, N, O and H.***

EXAMPLE	MAJOR FUNCTIONS
Enzymes	Catalyze chemical reactions and control whole metabolism of cell
Hormones	Regulate metabolic processes.
Hemoglobin	Carrier protein that transport O_2, lipids, metal ions etc.
Antibodies	Defend the body against pathogens.
Clotting proteins	Prevent loss of blood after injury.
Mitotic apparatus	Helps in movement of chromosomes during anaphase of cell division.

Amino acids

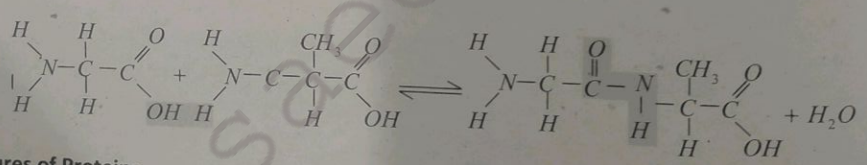
- About ***170*** types amino acids have been found in cells and tissues.
- Out of 170 types only ***25*** are constituents of proteins.
- Most of the proteins are however made of ***20*** types of amino acids.

Amino Acid Structure



Basic Structure of Amino Acid

- Amino acids link together to form a polypeptide molecule.
- In this figure –OH of carboxyl group of one amino acid combines with H of amino group of another amino acid releasing water and forming C-N link called ***peptide bond***.
- Two amino acid combine together via a peptide bond to form a dipeptide, e.g. Alanine and Glycine form ***glycylalanine***. Similarly tri, tetra and pentapeptides can be formed.



Structures of Proteins

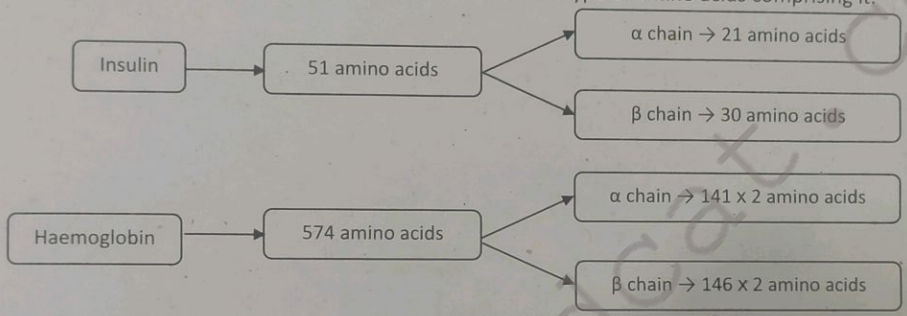
There are four levels of organization of protein molecules.

FEATURE	PRIMARY	SECONDARY	TERTIARY	QUATERNARY
Information	Number & sequence of amino acids in protein molecule.	Coiling or coil into a helix.	Bending & folding and forming globular shape.	Aggregation and held together by hydrophobic interactions.

Bonds	Disulphide bridges	Hydrogen	Ionic, Hydrogen, Disulphide (-s-s-)	Hydrogen, Ionic bonds.
Examples	Insulin , Hb	Alpha helix, β-pleated sheets	Single chain of haemoglobin	Haemoglobin molecule

Primary Structure

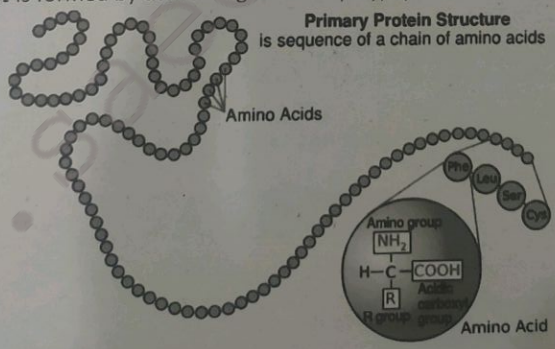
- ***F. Sanger*** was the first scientist who determined the sequence of amino acids in a protein molecule.
- The ***sequence of amino acids*** in a protein molecule is determined by the order of nucleotides in the DNA.
- The ***size*** of protein molecule depends upon number and type of amino acids comprising it.

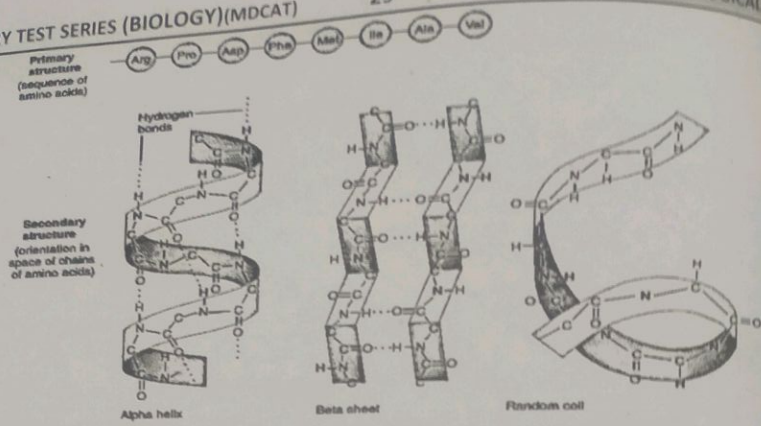


A ***change*** in even a single amino acid, results in the failure of that protein, which may even lead to death, e.g. **replacement of Glutamic acid by Valine in Hb molecule result in formation of HbS, which fails to carry Oxygen, the characteristic of Sickle cell anemia ultimately leading to death.**

Secondary Structure

- α – helix and β – pleated sheets are its ***examples***.
- ***α – helix*** is a very uniform geometric structure with 3.6 amino acids in each turn of the helix.
- ***β – pleated sheet*** is formed by the folding back the polypeptide.





Tertiary Structure

In aqueous environment, the most stable tertiary conformation is that in which hydrophobic amino acids are buried inside while the hydrophilic amino acids are on the surface of molecule.

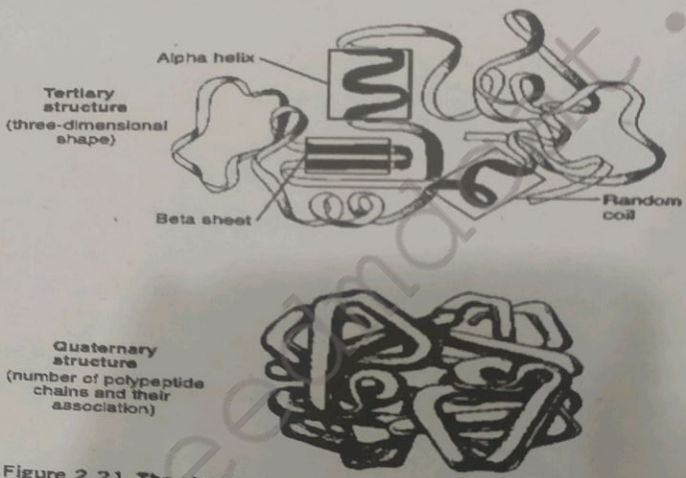


Figure 2.21 The structure of proteins. In the diagrams of secondary structure the R groups have been omitted so that the basic backbone can be seen more easily.

Quaternary Structure

Polypeptide tertiary chains are aggregated and held together by hydrophobic interactions.

Classification of Proteins

FEATURE	FIBROUS PROTEIN	GLOBULAR PROTEINS
Shape	Fibrils form	Spherical or ellipsoidal
Structural organization	Secondary	Tertiary
Solubility in aqueous media	Insoluble in aqueous media	Soluble
Crystal Nature	Non-crystalline	Crystalline
Elasticity	Elastic in nature	Inelastic

Role	Structural	Functional
Stability	Stable	Unstable
Examples	Silk fibers, myosin, fibrin, keratin	Enzymes, antibodies, hormones, hemoglobin.

MCQs of PROTEINS

1. **Fibrous proteins are:**
   A) In soluble in aqueous medium C) Crystalline
   B) Inelastic D) None of these
2. **Glycylalanine has how many peptide linkages:**
   A) One B) Two C) Three D) No one
3. **How many types of amino acids are found in cells and tissues:**
   A) 180 B) 20 C) 45 D) 170
4. **Glycylalanine is:**
   A) A polypeptide B) A dipeptide C) An amino acid D) A tripeptide
5. **Primary structure of protein is maintained by:**
   A) Ionic bond B) Disulfide linkage C) Hydrogen bonds D) Peptide Bond
6. **It is not fibrous:**
   A) Haemoglobin B) Myosin C) Silk D) Fibrin
7. **Most abundant protein:**
   A) Keratin B) Albumin C) Dehydrogenases D) Rubisco
8. **Globular proteins are soluble in aqueous solutions of:**
   A) Salt B) Alcohols C) Acids & bases D) All of these
9. **Polypeptide bends & folds upon itself forming a globular shape in which structure?**
   A) Tertiary B) Primary C) Secondary D) Quaternary
10. **Glycoproteins & glycolipids are structural integral component of:**
    A) Ribosome B) Golgi bodies C) Cell wall D) Plasma membrane
11. **Lipoproteins are basic structural framework of which?**
    A) Cell membrane B) Nuclear membrane C) All membrane D) Cell wall
12. **The percentage of proteins in the mammalian cell is:**
    A) 16 B) 17 C) 18 D) 20
13. **Carbon combines with nitrogen in amino acid linkages to form:**
    A) Peptide bond B) Ester bonds C) Glycosidic bonds D) Ionic bonds
14. **Enzymes, antibodies, hormones and hemoglobin are examples of:**
    A) Fibril proteins B) Globular proteins C) Fibrous proteins D) Tough proteins
15. **Which protein is involved in blood clotting?**
    A) Silk fiber B) Keratin C) Myosin D) Fibrin
16. **Which Protein has Quaternary Structure?**
    A) Keratin B) Haemoglobin C) Silk D) Fibrin
17. **Blood group antigen contains:**
    A) Glycoproteins B) Phospholipids C) Glycolipids D) Sphingolipids
18. **Myosin is a _____ type of protein.**
    A) Intermediate B) Simple C) Globular D) Fibrous
19. **Which molecular structure of enzyme is essential for activity of enzyme?**
    A) Primary Structure C) Secondary Structure
    B) Quaternary Structure D) Tertiary Structure
20. **Over 50% of the total dry weight of a cell consists of:**
    A) Lipids B) Proteins C) Carbohydrates D) Nucleic acids

21. **Movement of organs and organisms and movement of chromosomes during anaphase of cell division, are caused by:**
A) Carbohydrates B) Proteins C) Lipids D) Nucleic acids

22. **If 'R' is CH_3 the amino acid will be:**
A) Alanine B) Glycine C) Valine D) Glutamic acid

23. **Number of peptide bonds involved in maintenance of primary structure of each beta chain of hemoglobin is:**
A) 146 B) 145 C) 144 D) 143

24. **We know that there are _____ proteins in the human body:**
A) Less than 10,000 B) Over 10,000 C) 10,000 D) Many 10,000

25. **A protein strengthening to our bones and the walls of arteries is called:**
A) Fibrin B) Collagen C) Albumin D) Keratin

26. **The proteins, which regulate metabolic activities are:**
A) Hormones B) Enzymes C) Antibodies D) Carrier

27. **The number of amino acids in different proteins varies from:**
A) A few to a few thousands C) a few to 3000
B) A few to two thousands D) a few to 3000 or even more

28. **The primary structure of proteins comprises the _____ and _____ of amino acids:**
A) Size, shape B) Number, shape C) Number, size D) Number, sequence

29. **Number of peptide bonds involved in stabilization of a molecule of insulin is:**
A) 51 B) 50 C) 49 D) 48

30. **To make a peptide bond one amino acid loses _____ and other loses _____:**
A) N, OH B) H_2O,OH C) H, H_2O D) OH, H

31. **A polypeptide chain can be broken down into amino acids by:**
A) Dehydration B) Condensation C) Hydrolysis D) Polymerization

32. **Two polypeptide chains are linked together by a disulphide bond between:**
A) Glycerine molecules C) Tyrosine molecules
B) Alanine molecules D) Cysteine molecules

33. **Fibrous proteins have following properties EXCEPT:**
A) Insoluble in water C) Structural proteins
B) Crystalline nature D) Elastic nature

34. **A complete hemoglobin molecule, with four haem groups can carry:**
A) Two oxygen molecules at a time C) Four oxygen molecules at a time
B) Three oxygen molecules at a time D) Four oxygen atoms at a time

35. **Spider's web is a:**
A) Globular protein B) Functional protein C) Fibrous protein D) soluble protein

36. **The two chains of insulin are held together by:**
A) Peptidelinkage B) Disulphide bridge C) Sulphide linkage D) Hydrogen bonding

37. **Polypeptide bends & folds upon itself forming a globular shape in which structure?**
A) Tertiary B) Secondary C) Primary D) Quaternary

38. **In an aqueous environment the most stable tertiary conformation is that in which _____ amino acids are buried inside the conformation.**
A) Hydrophobic B) Basic C) Hydrophilic D) None of these

39. Actin and myosin are the basic proteins involved in contractile machinery of our body to which type of proteins do they belong?

A) Globular proteins
B) Intermediate protein
C) Fibrous Proteins
D) Integral protein

40. Number of peptide bonds involved in maintenance of primary structure of each beta chain of hemoglobin is:

A) 146
B) 145
C) 144
D) 143

S

Answers :

1.	A	2.	A	3.	D	4.	A	5.	D	6.	A	7.	D	8.	D	9.	A	10.	D
11.	C	12.	C	13.	A	14.	B	15.	D	16	B	17	A	18	D	19	D	20	B
21	B	22	A	23	B	24	B	25	B	26	A	27	D	28	D	29	C	30	D
31	C	32	D	33	B	34	C	35	C	36	B	37	A	38	A	39	C	40	B

LIPIDS

- Lipids are a heterogeneous group of compounds related to fatty acid.
- They are ***insoluble in water*** but ***soluble in organic solvents*** like ether, alcohol, chloroform and benzenes.
- Their hydrophobic nature makes them best suited to be a ***structural component of cell membranes.***
- Lipids store ***double the amount of energy*** as compared to same amount of carbohydrates because of high proportion of C-H bounds and very low oxygen.
- May act as ***insulating layer*** e.g. waxes exoskeleton of insects, and cutin which is as additional protective layer on the cuticle of epidermis of some plant organs, e.g. leaves, fruits, seeds.

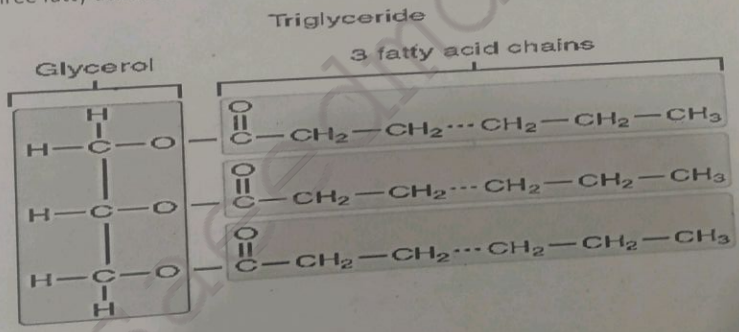
ACYLGLYCEROLS:

- **These are esters of glycerol and fatty acids.**
- **An aster is the compound produced as the result of a chemical reaction of an alcohol with acid and a water molecule is released.**

$$\text{Fatty acid} + \text{Glycerol} \longrightarrow \text{Acylglycerols} + H_2O$$

$$C_2H_5OH + HOOCCH_3 \longrightarrow C_2H_5COCH_3 + H_2O$$

- When three fatty acids combine with one glycerol, a triglycerol is formed.



FATTY ACID

- Fatty acid contains even number of carbon actions (2,....30) in straight chain attached with hydrogen and having an acidic group COOH (Carboxylic group).
- Solubility of Fatty Acids in organic solvents and melting points increases with increase in number of carbon atoms.

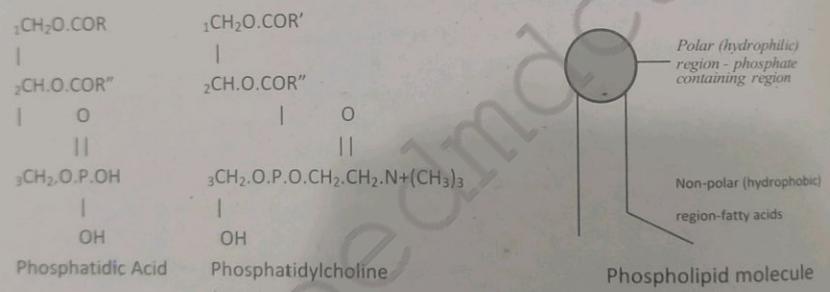
SATURATED FATTY ACID	UNSATURATED FATTY ACID
No double bonds	Upto six double bonds
Straight chain	Ringed / Branched
Solid at room temperature	Liquid at room temperature
Fats	Oils
Animals	Plants

WAXES

- Chemically, waxes are mixtures of long chain alkanes (with odd number of carbons ranging from C_{25} to C_{35}) and alcohols, ketones and esters of long provide water barrier for insects, birds and animals such as sheep.
- They act as ***protective coating*** on the fruits and leaves and thus protect them from water loss and abrasive damage.
- They also provide ***water barrier*** for insects, birds and animals such as sheep.

PHOSPHOLIPIDS

- They are the derivatives of ***phosphatidic acid***.
- They are frequently associated with ***biological membranes.***
- ***Phosphatidylcholine*** is one of its commonest examples also called lecithin.

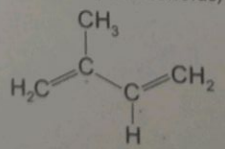


Phospholipid molecule

TERPENOIDS

They are made of simple repeating units called ***isoprenoids units***.

The examples of terpenoids include rubber, carotenoids, terpenes and steroids.



MCQs of LIPIDS

1. **Choline contains how many carbon and nitrogen atoms:**
   A) 4 – 1 B) 3 – 1 C) 5 – 1 D) 4 – 2
2. **Phosphatidic acid lacks:**
   A) Fatty acids B) Phosphate group C) Glycerol D) Choline
3. **Palmitic acid is more soluble than butyric acid in:**
   A) Ether B) Water C) Acid solutions D) Salt solution
4. **Glycerol donates which group to fatty acid to form triglyceride:**
   A) OH B) H C) Both a & b D) Phosphate
5. **How many possible double bonds may be present in fatty acids:**
   A) Two B) Three C) Four D) Six
6. **Melting point of Palmitic acid is:**
   A) 60.1 °C B) 63.1 °C C) - 8 °C D) 60.3 °C
7. **Specific gravity of fats and oils is:**
   A) 0.8 B) 1.8 C) 0.6 D) 0.08
8. **Why lipids form layers in membrane:**
   A)They are insoluble in water C) They are covalent
   B) They are polar D) They are organic
9. **Most common acylglycerols are:**
   A) Animal fats B) Plant fats C) Monoacylglycerol D) Triacylglycerol
10. **Waxes are:**
    A) Terpenoids C) Mixture of various compounds
    B) Glycerides D) Phospholipids
11. **Carotenoids are:**
    A) Carbohydrates B) Glycerides C) Lipids D) None of these
12. **Glycerol is _____ carbon alcohol:**
    A) 3 B) 4 C) 5 D) 6
13. **The most common phospholipids:**
    A) Phosphatidic acid B)Lecithin C) Choline D) Isoprenoids
14. **The esters of fatty acids and glycerol is:**
    A)Acylglycerol B) Palmitic acid C) Lecithin D) Phospholipid
15. **Rubber is a:**
    A) Carbohydrate B)Protein C)Terpenoid D)Acylglycerol
16. An example of a saturated fatty acid is
    A) Palmitic acid C) Oleic acid
    B) Linoleic acid D) Erucic acid
17. **A mono-unsaturated fatty acids having C 18, what is the formula**
    A) $C_{18}H_{35}COOH$ B) $C_{17}H_{35}COOH$ C) $C_{17}H_{33}COOH$ D) $C_{18}H_{33}COOH$
18. **Phosphatidic acid lacks**
    A) Fatty acids B) Glycerol C) Phosphate group D) Choline
19. **It is formed by the condensation of isoprenoids:**
    A) Carotenoids B) Chitin C) Pectin D) Dextrin
20. **Which biochemical would MOST likely be found as a component of a cell membrane?**

A) Hormone B) Disaccharide C) Triglyceride D) Phospholipid

21. **Lecithin consists of**
A) Glycerol, fatty acids, phosphoric acid and choline
B) Glycerol, fatty acids, phosphoric acid and ethanolamine
C) Glycerol, fatty acids, phosphoric acid and inositol
D) Glycerol, fatty acids, phosphoric acid and serine

22. **Which of the following is an unsaturated fatty acid?**
A) Acetic Acid B) Butyric acid C) Oleic acid D) Palmitic acid

23. **_____ is most abundant carbohydrate in nature.**
A) Waxes B) Glycerol C) Starch D) Cellulose

24. **Acylglycerols like fats and oils are esters formed by condensation reaction between:**
A) Fatty acids and water
B) Fatty acids and alcohols
C) Fatty acids and glucose
D) Fatty acids and phosphates

25. **Water proof surfaces like cuticle of leaf and protective covering of an insect's body are**
A) Phospholipids B) Waxes C) Terpenoids D) Acylglycerols

26. **A heterogeneous group of compounds related to fatty acids is that of:**
A) Carbohydrates B) Lipids C) Proteins D) Nucleic acids

27. **During the formation of triacylglycerol, we get:**
A) One water molecules
B) Two water molecules
C) Three water molecules
D) four water molecules

28. **In animals the fatty acids are:**
A) Branched B) Straight chain C) Ringed D) Unsaturated

29. **Phospholipids are derivatives of:**
A) Phosphatidic acid
B) Phosphatidylcholine
C) Lecithin
D) Phosphatidylserine

30. **Pick up the one which is a terpenoid:**
A) Wax B) Cutin C) Rubber D) Lecithin

31. **The most common type of lipids is that of:**
A) Waxes B) Phospholipids C) Triglycerides D) Terpenoids

32. **Attaching a hydrocarbon tail to a –COOH group _____ is synthesized:**
A) Triglyceride B) Glycerol C) Fatty acid D) Wax

33. **Maximum amount of energy is stored by:**
A) Lipids B) Proteins C) Nucleic acids D) Carbohydrates

34. **Pick up the one which is not a lipid:**
A) Acylglycerol B) Waxes C) Chitin D) Steroid

35. **_____ are one of the most important components of triglyceride:**
A) Alcohols B) Glycerols C) Esters D) Fatty acids

36. **Lecithin minus choline is equal to:**
A) Phosphatidylcholine
B) Phospholipids
C) Phosphatidic acid
D) Glycerol

37. **Triglycerides are esters of _____ fatty acids and _____ glycerol/s:**
A) 3,1 B) 1,3 C) 3, 3 D) 1, 1

38. **A compound produced as a result of a chemical reaction of an alcohol with an acid in which water molecule is released is called:**
A) Monosaccharide
C) Fatty acid

B) Neutral lipid
D) Nucleic acid

39. **Melting point of a fatty acid decreases by:**
A) Increasing number of carbon atoms
B) Decreasing number of double bonds
C) Decreasing number of carbon atoms
D) Increasing number of double bonds and decreasing number of carbon atoms

40. **Which of the following statement is incorrect for fats containing unsaturated fatty acid?**
A) They contain double bond
B) They are lighter than water
C) They are usually solid at room temperature
D) Their specific gravity is less than 1

Answers :

1.	C	2.	D	3.	A	4.	A	5.	D	6.	B	7.	A	8.	A	9.	D	10.	C
11.	C	12.	A	13.	B	14.	A	15.	C	16.	A	17	C	18	D	19	A	20	D
21	A	22	C	23	D	24	B	25	B	26	B	27	C	28	B	29	A	30	C
31	B	32	C	33	A	34	C	35	D	36	B	37	A	38	B	39	D	40	C

NUCLEIC ACIDS

SCIENTIST	DISCOVERY
Friedrich Miescher	Nucleic acid in nuclei of pus cells
P. A. Levene	Basic structure of nucleic acids
Ervin Chargaff	Ratio of different bases present in DNA molecule
Maurice Wilkins & Rosalind Franklin	X-rays diffraction analysis of DNA
ames Watson & Francis Crick	Scale model of DNA Semiconservative replication of DNA
redrich Griffith	Transformation, First evidence of DNA as heredity material
very, McLeod & McCarty	DNA as transforming principle
lfred Hershey & Martha Chase	Confirmative evidence of DNA as heredity material
leselson & Stahl	Confirmation of semi conservation replication of DNA
larshal Nirenberg, Philip Leader and Har obind Khorana	Testing of 64 codons
kazaki	Okazaki fragments during DNA replication

Nucleic acid were first isolated by ***F. Miescher*** from nuclei of pus cells.

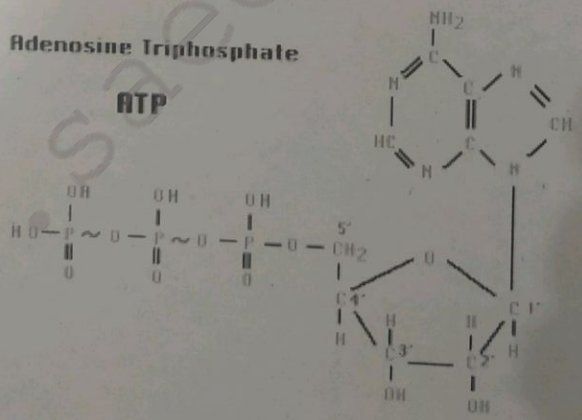
They are called nucleic acid, since they were first isolated from nuclei and are acidic in nature.

ATP is an important nucleotide used as an energy currency by the cell.

DNA and RNA made up of repeating units called ***nucleotide.***

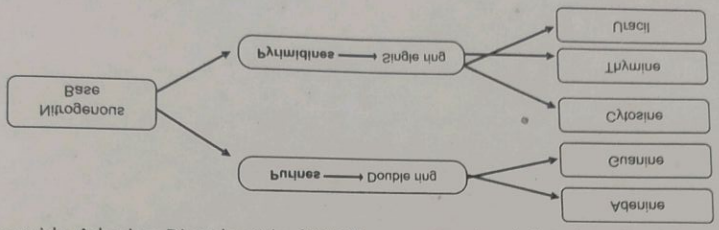
Adenosine Triphosphate

ATP

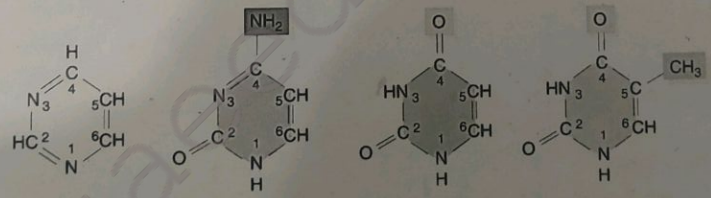


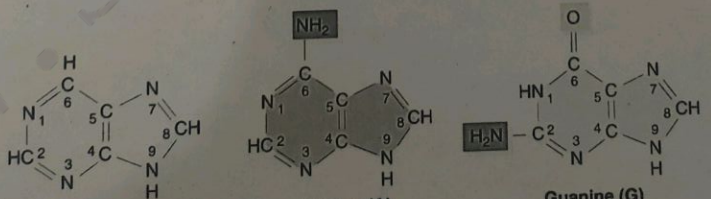
DEOXYRIBONUCLEIC ACIDS (DNA)

- DNA is made up four kinds of ***nucleotides*** namely d-adenosine monophosphate (d-AMP), d-guanosine monophosphate (d-TMP) d-cytidine monophosphate (d-CMP) and d-thymidine monophosphate (d-TMP).

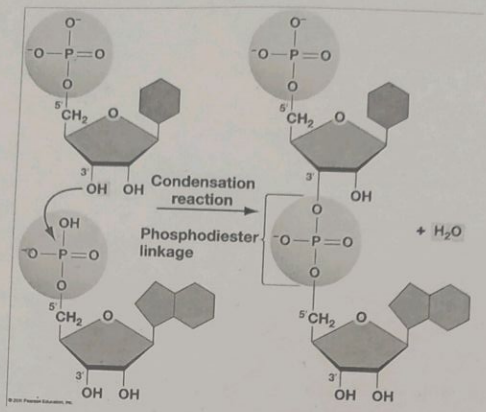


- Nicotinamide Adenine Dinucleotide ***(NAD)*** is an example of dinucleotide and an important co-enzyme in several oxidation-reduction reactions in the cell.
- In 1951, ***Erwin Chargaff*** provided data about the ratios of different bases present in a DNA molecule.
- In each turn of DNA, there are about 10 base pairs of about 34 Angstrom units.
- **Haemophilus influenza is the first microbe to have the genome completely sequenced.**
- Basic structure of nucleic acids was determined by the biochemist ***P.A Levene*** in 1920.
- DNA contains 3 main components i.e. phophate group, 5 carbon sugars, purines and pyrimidines.
- ***Purines*** → adenine and guanine
- ***Pyrimidines*** → thymine and cytocine, RNA contains uracil instead of thymine

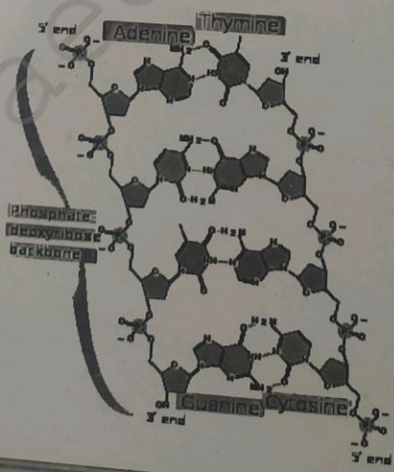




- ***Phosphodiester bond*** is present between two nucleotides.



- ***Erwin Chargaff*** showed that the amount of adenine= amount of thymine
  Amount of guanine= amount of cytosine
- ***Maurice Wilkins and Rosalind Franklin*** described X-ray diffraction analysis of DNA.
- **According to Watson & Crick**, DNA is made up of two polynucleotide chains or strands and has a simple double helix shape with a diameter of 2nm.
- **In each turn of DNA , there are about 10 base pairs of about 34 Angstrom.**
- **Base pairs are flat with a distance of 0.34 nm between them.**
- ***Hydrogen bonds*** exist between the bases in a base pair.
- Adenine forms two hydrogen bonds with thymine and guanine forms three hydrogen bonds with cytosine.



Ratios between Different Nitrogenous Bases

Source of DNA	Adenine	Guanine	thymine	Cytosine
Man	30.9	19.9	29.4	19.8
Sheep	29.3	21.4	28.3	21.0
Wheat	27.3	22.7	27.1	22.8
Yeast	31.3	18.7	32.9	17.1

Amount of DNA in Somatic and Germ Cells

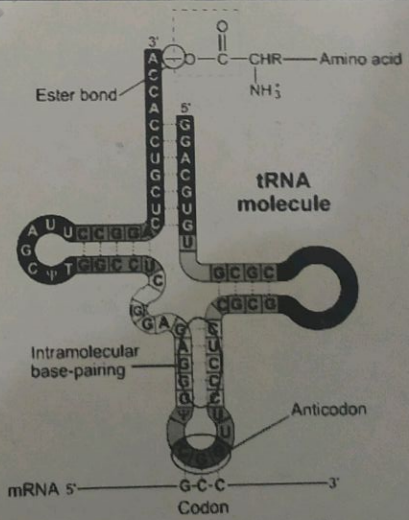
Type of cell	Amount of DNA /nucleus in picogram in Chicken	Amount of DNA / nucleus in picogram in Carp
Red Blood Cells	2.3	3.3
Liver Cells	2.4	3.3
Kidney Cells	2.4	3.3
Sperm Cells	1.3	1.6

C) RNA AND ITS TYPES

FEATURE	mRNA	tRNA	rRNA
Function	Takes message from DNA	Transfers amino acids	Formation of ribosomes
Length	Single strand of variable lengths	Length of 75-90 nucleotides	Constant length
Percentage	3-4%	10-20%	80%

Messenger RNA (mRNA)

- It takes the genetic message from the nucleus to ribosome in the cytoplasm, where amino acids are arranged to form a specific protein molecule.
- It consists of a single strand of variable length, which depends upon the size of the gene as well as the protein for which it is taking the message.



Transfer RNA (tRNA)

- It transfers amino acid molecules to the sites where peptide chains are being synthesized.
- There is one specific tRNA for each amino acid. So there are at least 20 kinds of tRNA molecules and (tRNA) picks amino acid and transfer them to ribosomes.
- Human cells contain about 45 different kinds of tRNA molecules.

Ribosomal RNA (rRNA)

- It acts as a machinery for the synthesis of proteins.

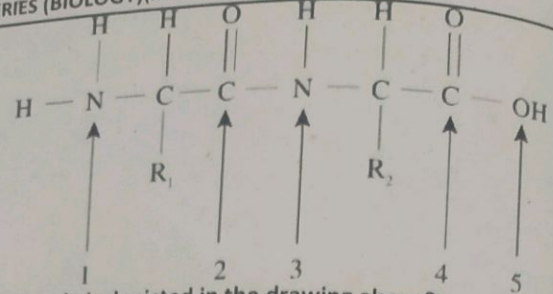
- It is strongly associated with the ribosomal proteins where 40-50 of it is present.

Difference between DNA and RNA

FEATURE	DNA	RNA
Nucleotides	Deoxyribonucleotides	Ribonucleotides
Pentose Sugar	Deoxyribose	Ribose
Nitrogenous Bases	A, G, C, T	A, G, C, U
Physical Structure	Double strands	Single strand
Location	Chromosome, Nuclei and in much lesser amount in mitochondria and chloroplasts	Nucleolus, ribosomes, cytosol and in smaller amount in other parts of the cell.
Amount	Constant in each cell of species	Variable from cell to cell
Role	Heredity	Protein synthesis

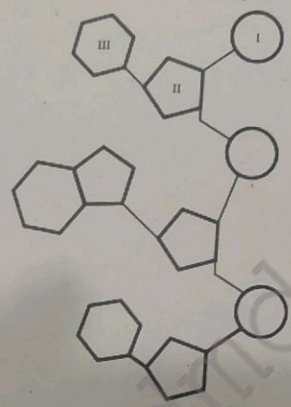
MCQ'S OF NUCLEIC ACID

1. **The length of one turn of DNA double helix is:**
   A) 34 nm B) 3.4 nm C) 3.4A D) 0.34nm
2. **Adenine shows how many oxygen atoms.**
   A) One B) Two C) Three D) No one
3. **NAD is a/an:**
   A) Nucleotide B) Co-enzyme C) Respiratory protein D) Both a and b
4. **How many nucleotides form tRNA:**
   A) 60 – 75 B) 75 – 90 C) 70 – 80 D) 60 – 80
5. **DNA contents in mammalian cells:**
   A) 1.1% B) 2% C) 0.25% D) 4%
6. **Which forms a nucleoside:**
   A) Deoxyribose + nitrogenous base
   B) Deoxyribose + nitrogenous base + phosphoric acid
   C) Ribose + phosphoric acid
   D) Ribose + nitrogenous base + phosphoric acid
7. **There are _____ kinds of nucleotides which are present in DNA:**
   A) 12 B) 8 C) 4 D) 2
8. **Amount of DNA is fixed for a particular:**
   A) Tertiary structure of DNA C) Community
   B) Secondary structure of DNA D) Specie
9. **Two polynucleotide chains are held together by hydrogen bonds, this is its:**
   A) Tertiary structure C) Primary structure
   B) Secondary structure D) None of these
10. **E. coli genome has approximately 5 million:**
    A) Bases in single DNA C) Base pairs in a paired strand RNA
    B) Bases in DNA duplex D) None of these
11. **A eukaryotic ribosome contains how many percent of protein:**
    A) 50% C) 60-70%
    B) 50-60% D) 20-30%
12. **How many kinds of rRNA are found in eukaryotic ribosomes?**
    A) 4 B) 3 C) 2 D) 1
13. **The amount of DNA / nucleus in sperm cell of chicken in picogram is:**
    A) 2.3 B) 2.4 C) 3.3 D) 1.3
14. **Compound formed by combination of base and ribose sugar?**
    A) Nucleoside B) d-Nucleoside C) d-Nucleotide D) Nucleotide
15. **Which has ability to form ester linkage with OH group of pentose sugar?**
    A) Nucleoside B) Phosphoric acid C) Nitrogenous bases D) Adenine



16. **What type of molecule is depicted in the drawing above?**
A) Protein
B) Carbohydrate
C) Lipid
D) Nucleic acid

17. **Which of these labels matches the structure of the partial RNA strand shown?**



A) I. Phosphate; II. ribose; III. nitrogen base
B) I. Phosphate; II. nitrogen base; III. Ribose
C) I. Nitrogen base; II. phosphate; III. ribose
D) I. Ribose; II. nitrogen base; III. Phosphate

18. **Which answer choice matches the functions listed below to the correct RNA types?**
I. Interprets a codon as an amino acid
II. Binds to a gene transcript
III. Contains information for assembling a protein
A) I. mRNA; II. rRNA; III. tRNA
B) I. mRNA; II. tRNA; III. rRNA
C) I. tRNA; II. mRNA; III. rRNA
D) I. tRNA; II. rRNA; III. mRNA

19. **If one ribose molecule were bonded to one adenine molecule and one phosphate molecule we would have a**
A) Ribosome
B) Nucleotide
C) Nucleic acid
D) ATP

20. **3' end of the polynucleotide chain bears:**
A) Phosphate group
B) Methyl group
C) Hydroxyl group
D) Nitro group

21. **Thymine can also be designated as:**
A) 3–Methyl uracil
B) 4–Methyl uracil
C) 2–Methyl uracil
D) 5–Methyl uracil

22. **J. D. Watson and F.H. Crick utilized X-ray diffraction data produced by:**

A) Rosalind Wilkins and Maurice Franklin
B) Sutton and Boveri
C) Maurice Wilkins and Rosalind Franklin
D) None of these

23. **In deoxyribose oxygen atom is removed from carbon number:**
A) 1 B) 3 C) 2 D) 4

24. **The combination of a pentose sugar with a base result in a compound is known as:**
A) Nucleotide B) Nucleoside C) Nucleic Acid D) Polynucleotide

25. **It is strongly associated with ribosomal protein where 40 to 50% of it is present:**
A) mRNA B) rRNA C) snRNA D) tRNA

26. **The RNA molecules mostly occur as a:**
A) Duplix
B) Double stranded structure
C) Single stranded structure
D) Genetic material

27. **All three types of _____ are synthesized from _____ in the _____:**
A) RNA, DNA, Nucleus
B) RNA, Nucleus, DNA
C) DNA, RNA, Nucleus
D) Nucleus, RNA, DNA

28. **This type of RNA consists of a single strand of variable length:**
A) Messenger RNA B) Ribosomal RNA C) Transfer RNA D) snRNA

29. **It comprises about 10 to 20% of the cellular RNA:**
A) mRNA B) tRNA C) rRNA D) snRNA

30. **Transfer RNA molecules are small, each with a chain length of:**
A) 70 to 80 nucleotides
B) 75 to 80 nucleotides
C) 75 to 85 nucleotides
D) 75 to 90 nucleotides

31. **It is the major form of RNA in the cell:**
A) rRNA B) tRNA C) mRNA D) snRNA

32. **On the surface of _____ the mRNA and tRNA interact to translate the information from genes into a specific proteins:**
A) rRNA B) Chromosome C) Ribosome D) Nucleosome

33. **_____ are the information storage devices of the cells, as disks store the information that computers use:**
A) Nucleic acids B) Chromosomes C) Nucleus D) Chromatic material

34. **In nucleic acids adenine can make a base pair with:**
A) Guanine B) Thymine C) Uracil D) Thymine or uracil

35. **A DNA sample having 34% Adenine will have what percentage of cytosine:**
A) 16% B) 32% C) 34% D) 68%

36. **The difference between Uracil and Thymine is that of:**
A) Carbon atoms B) Ring structures C) Methyl ($-CH_3$) D) Position of oxygen

37. **Which one of the following is a larger nitrogenous base:**
A) Adenine B) Cytosine C) Thymine D) Uracil

38. **Transfer RNA molecules are small, each with a chain length of:**
A) 70 to 80 nucleotides
B) 75 to 80 nucleotides
C) 75 to 85 nucleotides
D) 75 to 90 nucleotides

39. **Nucleotides are formed by**

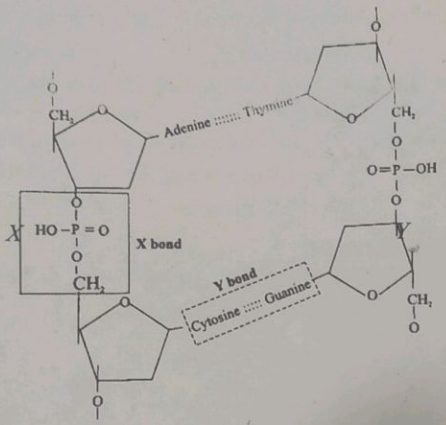
A) Purine, sugar and phosphate

B) Purine, pyrimidine and phosphate

C) Purine, pyrimidine, sugar and phosphate

D) Pyrimidine, sugar and phosphate

40. Which bonds are indicated by X and Y in the given diagram?



A) Glycosidic bond

B) Phosphodiester bond

C) Glycosidic bond

D) Phosphodiester bond

(i) Hydrogen bond

(ii) Hydrogen bond

(iii) Phosphodiester bond

(iv) Glycosidic bond

Answers :

1.	B	2.	D	3.	D	4.	B	5.	C	6.	A	7	C	8.	D	9.	B	10.	B
11	B	12	D	13	D	14	A	15	B	16	A	17	A	18	D	19	B	20	C
21	D	22	C	23	C	24	B	25	B	26	C	27	A	28	A	29	B	30	D
31	A	32	C	33	A	34	D	35	A	36	C	37	A	38	D	39	C	40	B

ENZYME

- Enzymes are biological molecules (proteins) which catalyze a biochemical reaction and remain unchanged after completion of reaction is called enzymes.
- All are globular proteins, having specific chemical composition due to their component amino acids and specific shape.
- Even small amount of them can tremendously increase the efficiency of a biochemical reaction.
- They are specific for each type of a reaction or group of related reactions.
- Their presence does not affect the nature or properties of end products.
- They lower the activation energy of the reactants.
- They are sensitive to even a minor change in pH, temperature and substrate concentration.
- They require aqueous media for their activity.
- Some may require co-factor for their proper functioning.
- Some enzymes are potentially damaging, if they are manufactured in their active form.

D) **DEFINITION OF TERMS**

- Enzymes are biologically active proteins and are called as **biochemical catalysts.**
- The catalytic activity of an enzyme is due to **active site**. It is a small protein of enzyme consisting of few amino acids.
- The enzyme and its substrate react with each other through active sites.
- The active site is a **three dimensional cavity** bearing a specific charge.
- Most of the enzymes have a non-protein part known as **a co-factor**.
- Cofactor is directly involved in chemical reaction for catalysis Cofactor acts as **"bridge"** between enzyme and its substrate. **Sometimes the co-factor provides energy to drive the reactions.**
- There are three kinds of as cofactor:

(a) The detachable ion (metal ion) working as co-factor is known as an **activator.** Example: **Cu/ Zn.**

(b) The covalently bonded non-protein part of enzymes is known as **prosthetic group**. Example: **Lipids**

(c) If the non–protein part is loosely attached to the protein part, it is known as **coenzyme.** Example: **Vitamins**.

- An enzyme with its coenzyme or prosthetic group removed is called **Apoenzyme**.
- An activated enzyme consisting of polypeptide chain and a cofactor is known as **Holoemzyme**.
- The conditions under which enzymatic activity is destroyed by disrupting bonds between the atoms in an enzyme are: High temperature and extreme changes in pH.
- Enzymes are also produced in the cells near the site of function.
- Many enzymes are dissolved in the cytoplasm. Others are bound to the subcellular organelles. For example:

(a) Enzymes for photosynthesis are present in the **Chloroplasts**.

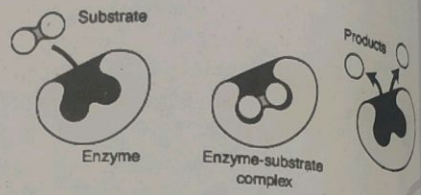
(b) Enzymes for cellular respiration are present in the **Mitochondria**.

(c) Some enzymes of protein synthesis are present in **Ribosomes**.

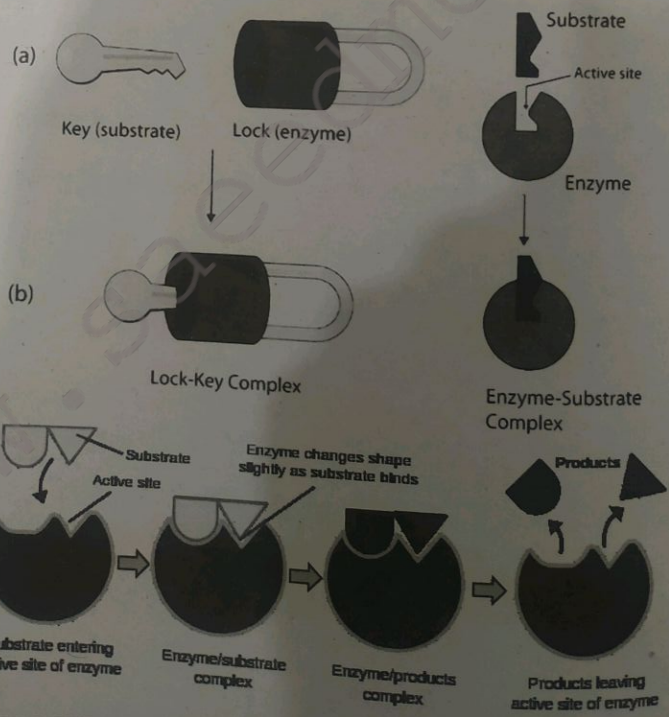
- All metabolic activities occurring in the cells are carried out by specific enzymes.

- Some enzymes are damaging if they become active in the wrong place. Pepsin is produced in inactive pepsinogen form. If it is produced in the active form it may cause cancer.

E) MECHANISM OF ENZYME ACTION



- Enzymes are specific in their action, any enzyme, therefore react with its specific substrate and transforms it into product (s) without itself being utilized.
- The active site of an enzyme is a three dimensional cavity bearing a specific charge by which the enzyme reacts with its substrate.
- The active site is made of two definite regions i.e. binding site & a catalytic site.
- Binding site helps the enzyme in the recognition and binding of the proper substrate to produce an ES complex.
- Formation of ES complex activates the catalytic site.
- **Emil Fischer (1890)** proposed lock and key model.
- As one specific key can open a specific lock, n the same manner a specific enzyme can transform a specific substrate into product (s).
- According to this model active site is a rigid structure and thus there is no modification or flexibility in the active site before, during or after the enzyme action.
- It was proved latter on that all the chemical reactions can't be explained on the basis of this reaction.



- **Koshland (1959)** proposed induce fit model.
- It is the modified form of lock and key model.
- It states that when a substrate combines with an enzyme, it induce changes in the enzyme structure. This change in the structure allows enzyme to carry out its catalytic activity more effectively.

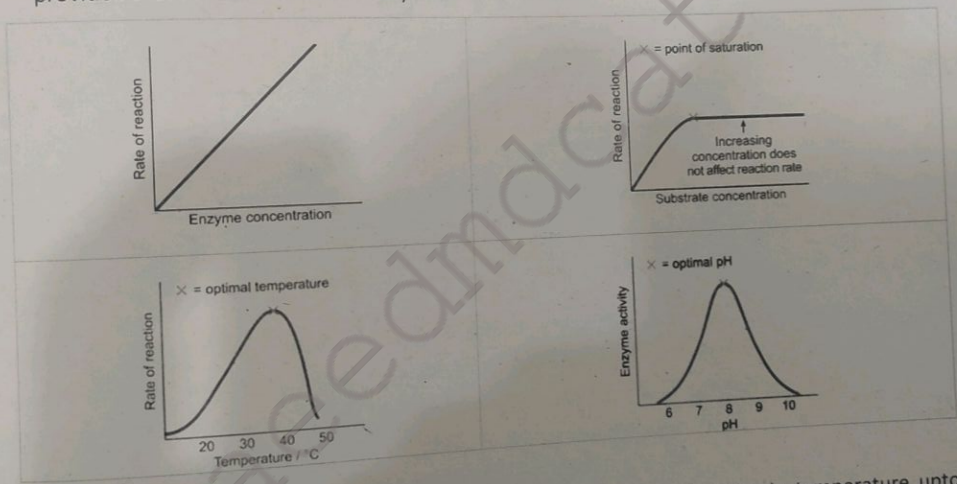
I) FACTORS AFFECTING ENZYME ACTION

ENZYME CONCENTRATION

- Rate of reaction is directly proportional to amount of enzyme present, which in turn determines the number of available active sites for that particular catalytic reaction.
- If the amount of an enzyme is increased by two fold the reaction rate will be doubled.
- However, after a certain limiting concentration, the rate of the reaction will no longer depend upon this increase.

SUBTRATE CONCENTRATION

- The rate of a enzyme controlled reaction is directly proportional to the substrate concentration provided that active sites on the enzyme are available.

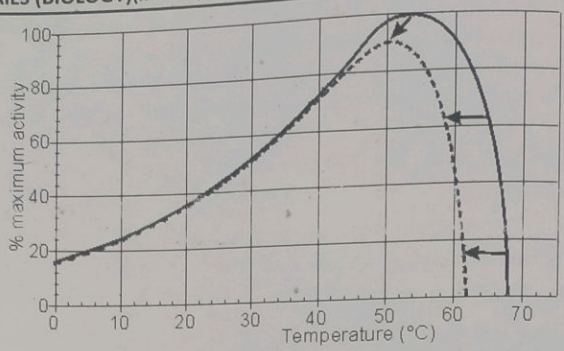


TEMPERATURE

- The rate of an enzyme controlled reaction increases with an increase in temperature upto certain limits.
- Optimum temperature is the temperature at which an enzyme works at its maximum rate e.g. for enzymes of our body it is $37^{\circ}C$ is optimum temperature.

pH VALUE

- Optimal pH is the range of pH at which an enzyme functions acts most effectively.



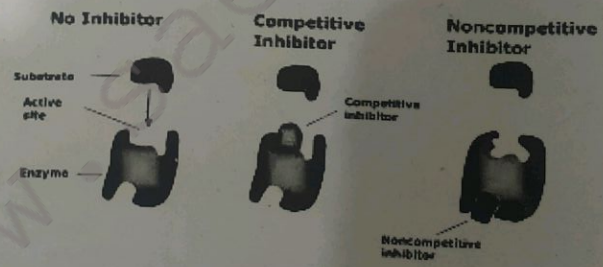
- Extreme changes in pH cause the bonds in the enzyme to break, resulting in the enzyme denaturation.

ENZYME	FUNCTION	pH VALUE
Pepsin	Digestion of proteins	2.00
Sucrose	Hydrolysis of sucrose	4.50
Enterokinase	Activation of trypsinogen	5.50
Salivary amylase	Digestion of carbohydrate	6.80
Catalase	Decomposition of hydrogen peroxide	7.60
Chymotrypsin	Involved in proteolysis	7.00-8.00
Pancreatic lipase	Hydrolysis of fats	9.00
Arginase	Catalysis of arginine into urea	9.70

J) INHIBITORS

- An inhibitor is a chemical substance which can react (in place of substance) with the enzyme but it is not transformed into products and thus active site temporarily or permanently.
- Examples include cyanide, antibiotics, anti-metabolites, drugs.
- They are of two types of inhibitors i.e. reversible and irreversible inhibitors.

Enzyme Inhibitors



Irreversible Inhibitor

- They occupy the active sites by forming covalent bonds or they may physically block the active sites and they check the reaction rate by occupying the active site.

Reversible Inhibitors

- They form weak linkage with the enzyme.
- Their effect can be neutralized, completely or partly by increase in the concentration of the substance.
- They are two types of reversible inhibitors i.e. competitive and non-competitive.
- Competitive inhibitors are structurally similar to the substrate, hence can bind to the active site but can't activate the catalytic site, thus no products are formed.
- Non-competitive inhibitors bind with the enzyme at the site other than active site. Structure of enzyme is altered, so that even a genuine substrate binds the active site, catalysis fails to take place.

MCQ'S OF ENZYME

1. **Heat provides:**
   A) Activation energy C) Kinetic energy
   B) Excitation energy D) All of these
2. **How enzymes increase the rate of reaction:**
   A) Provide energy of activation C) Increase temperature
   B) Lower energy of activation D) Alter Kc value
3. **Covalently bounded cofactor is:**
   A) Prosthetic group B)ATP C)NADP D)Mg^{2+}
4. **Enzymes form _____ in cell's cytoplasm:**
   A) Suspension B) Solution C) Colloidal Solution D) All of these
5. **Which structure is most important for enzyme?**
   A) Primary B) Secondary C) Tertiary D) Quaternary
6. **Enzymes have _____ shape:**
   A) Fibrous B) Filamentous C) Globular D) None of these
7. **If the initial rate of reaction is increased:**
   A) -ive feedback B) +ive feedback C) Inhibition D)Precursor activation
8. **Enzymes are highly _____ in nature:**
   A) Energetic B) Motile C) Specific D) Effective
9. **Optimum pH of pancreatic amylase is:**
   A) 9.70 B) 9.00 C) 4.50 D) 2.00
10. **Which statement about enzyme is not true:**
    A) They consist of protein
    B) They change the rate of catalyzed reaction
    C) They are sensitive to heat
    D) They are non specific in nature
11. **Enzymes important for photosynthesis are found in:**
    A) Ribosomes B) Mitochondria C) Golgi complex D) Chloroplast
12. **Haem is an iron containing pigment it acts as:**
    A) Inhibitor B) Prosthetic group C) Activator D) Cofactor
13. **They usually act as a bridge between enzyme and substrate:**
    A) Coenzyme B) Activator C) Prosthetic group D) All of these
14. **What is optimum PH of sucrose?**
    A) 9.70 B) 4.50 C) 5.50 D) 2.40
15. **The optimum pH of pepsin is:**
    A) 2.00 B) 4.00 C) 3.00 D) 1.00
16. **All enzymes can work at their maximum rate at a specific temperature called as:**
    A) Suitable temperature C) Optimum temperature
    B) Minimum temperature D) Maximum temperature
17. **It is a chemical substance which can react in place of substrate, with enzyme, but is not transformed into products:**
    A) Cyanide B) Inhibitor C) Antibodies D) Antimetabolites
18. **Which step causes activation of catalytic site of an enzyme?**
    A) Change in pH of the surroundings C) Formation of Enzyme Substrate complex
    B) Change in the charge of the active site D) Change in temperature

19. **Which of the following statement is incorrect about RNA?**
A) The pentose sugar in it is Ribose
B) It contains Adenine Guanine Thymine and Cytosine
C) It is present in the nucleoli
D) It may be folded back on itself to give double helical characteristics.

20. **In a feedback mechanism, the final product _____ the enzyme of first step:**
A) Inhibits B) Stimulates C) Activates D) Regulates

21. **Maximum amount of DNA occurs inside the nucleus, however a small amount of DNA is always located outside the nucleus in:**
A) Mitochondria B) Chloroplast C) Plasmid D) Mitochondria and Chloroplast

22. **The factor that affect the rate of enzyme catalysis actually affect the _____ and _____ of enzyme:**
A) Chemistry, shape
B) pH and temperature
C) Ionization and temperature
D) Kinetic energy and temperature

23. **_____ the reaction rate is directly proportional to the substrate available:**
A) At high conc. of substrate
B) At high conc. of enzyme
C) At low conc. of substrate
D) At low conc. of enzyme

24. **Which of these is likely to reduce enzyme activity?**
I. Increasing pH level
II. Decreasing temperature
III. Placing enzyme in a nonpolar liquid
A) II only B) I and II C) III only D) I, II, and III

25. **As a reaction proceeds, reactants form a transition state, which then forms the products. An enzyme affects the energy of the**
A) Products only B) Reactants only C) transition state only D) products and reactants

26. **Which term most nearly means substrate?**
A) Reactant B) Product C) Activation energy D) Active site

27. **Which of these describes a characteristic of the induced-fit model but not the lock-and-key model?**
A) The substrate binds to the active site.
B) The enzyme lowers the activation energy of the reaction.
C) The enzyme is changed by the substrate.
D) The substrate is chemically changed by the enzyme.

28. **9.70 is the optimum PH for:**
A) Arginase B) Chymotrypsin C) Pancreatic lipase D) Salivary Amylase

29. **The optimum pH for sucrase is:**
A) 6.80 B) 4.50 C) 5.50 D) 7.60

30. **Such cofactor that make the weak linkage with the Enzyme:**
A) Reversible inhibitors B) Co Enzyme C) Activator D) Activator and Co Enzyme

31. **It increases the vibration of atoms which make up enzyme molecule**
A) PH B) Inhibitors C) Substrate conc D) Heat

32. **Active site by virtue of its flexibility becomes complementary to substrate**
A) Induced fit model
B) Emil Fischer's proposal
C) Lock and key model
D) Statement is wrong

33. **It has optimum pH of 9.0**
A) Pancreatic lipase B) Chymotripisn C) Arginase D) Catalase

34. **They check the reaction rate by blocking the active sites or destroying globular structure**
A) Competitive inhibitors
B) Irreversible inhibitors
C) Reversible inhibitors
D) Non-competitive inhibitors

35. **An enzyme and substrate reacts through a special feature or site present in enzyme:**
A) Building Site B) Active Site C) Catalyst Site D) Inhibition Site

36. **The non-protein part of enzyme which is covalently and permanently bonded is called:**
A) Prosthetic Group B) Co-Factor C) Co-Enzyme D) Activator

37. **The inhibitors that bind tightly and permanently to enzymes and destroy their globular structure and catalytic activity are:**
A) Reversible inhibitors
B) Irreversible inhibitors
C) Competitive inhibitors
D) Non-competitive inhibitors

38. **Enzyme succinate dehydrogenase converts succinate into**
A) Malate B) Malonic acid C) Citrate D) Fumarate

39. **If the detachable cofactor is an inorganic ion then it is designated as:**
A) Coenzyme B) Prosthetic group C) Holoenzyme D) Activator

40. **The view that active site of an enzyme is flexible and when a substrate combines with it, cause changes in enzyme structure is known as:**
A) Lock & key model
B) Induce fit model
C) Sliding filament model
D) Specificity model

Answers :

1.	D	2.	B	3.	A	4.	C	5.	C	6.	C	7	B	8.	C	9.	A	10.	D
11	D	12	B	13	D	14	B	15	A	16	C	17	B	18	C	19	B	20	A
21	D	22	A	23	C	24	D	25	C	26	A	27	C	28	A	29	B	30	D
31	D	32	A	33	A	34	B	35	B	36	A	37	B	38	D	39	D	40	B

ASSESS YOURSELF

1. **The covalent bond formed between two monosaccharides is called?**
   A) Glyosidic bond B) Hydrogen bond C) Peptide bond D) Disulphide bond
2. **The bond formed between glucose and fructose to form sucrose is:**
   A) 1,4 glycosidic linkage C) 1,6 glycosidic linkage
   B) 1,2 glycosidic linkage D) 1,3 glycosidic linkage
3. **In an amino acid, in which the R group is hydrogen, the amino acid will be:**
   A) Alanine B) Glycine C) Leucine D) Valine
4. **Fatty acids are organic compounds containing hydrogen, oxygen and one of the following group:**
   A) Carboxylic B) Amino C) Acyl D) Sucrose
5. **The combination of a pentose sugar with a base results in a compound known as**
   A) Nucleotide B) Nucleoside C) Nucleic acid D) Polynucleotide
6. **An enzyme and substrate reacts through a special feature or site known as**
   A) Building site B) Active site C) Catalytic site D) Activator
7. **The non-protein part of an enzyme which is covalently or permanently bonded is called:**
   A) Prosthetic group B) Co-factor C) Co-enzyme D) Activator
8. **One of the following pyramidine bases is absent in DNA:**
   A) Uracil B) thymine C) Cytosine D) Adenine
9. **Enzymes increase the rate of reaction by**
   A) Increasing temperature C) Decreasing activation energy
   B) Decreasing pH D) Increasing activation energy
10. **Carbohydrates are organic molecules and contain three elements:**
    A) Carbon, water and oxygen C) Carbon, calcium and hydrogen
    B) Carbon, Sulphur & oxygen D) Carbon, hydrogen and oxygen
11. **Which are intermediates in respiration and photosynthesis both?**
    A) Ribose and heptose C) Glucose and galactose
    B) Glyceraldehyde & Dihydroxyacetone D) Fructose and ribose
12. **Which one of the following is a peptide bond?**
    A) - C–N B) - C-O C) -C-P D) -C-S
13. **Which of the following is an unsaturated fatty acid?**
    A) Acetic acid B) Butyric acid C) Oleic acid D) Palmitic acid
14. **Which one of the following combination of base pairs is absent in DNA?**
    A) A-T B) C-G C) A-U D) T-A
15. **The type of inhibition in which has no structural similarity to substrate and combines with enzyme at other than the active site is called:**
    A) Irreversible inhibition C) Noncompetitive and reversible
    B) Reversible inhibition D) Competitive inhibition
16. **The inhibitors that binds tightly and permanently to enzymes and destroy their globular structure and catalytic activity are:**
    A) Reversible inhibitors C) Competitive inhibitors
    B) Irreversible inhibitors D) Noncompetitive inhibitors
17. **Enzyme succinate dehydrogenase converts succinate into:**
    A) Malonate B) Malonic acid C) Citrate D) Fumarate

18. **If the detachable co-factor is an organic ion then it is designated as:**
A) Coenzyme B) Prosthetic group C) Holo enzyme D) Activator

19. **_____Is most abundant carbohydrate in nature.**
A) Waxes B) Glycerol C) Starch D) Cellulose

20. **Which of the following is a ketosugar:**
A) Glyceraldehyde B) Dihydroxy-acetone C) Ribose D) Glucose

21. **Amino acid in which the R-group is hydrogen is:**
A) Glycine B) Alanine C) Leucine D) Valine

22. **Acylglycerols like fats and oils are esters formed by condensation reaction between:**
A) Fatty acids and water
B) Fatty acids and alcohols
C) Fatty acids and glucose
D) Fatty acids and phosphates

23. **Which of the following is purine:**
A) Guanine B) Cytosine C) Thymine D) Uracil

24. **If the co-factor is covalently or tightly and permanently bonded to enzyme then it will be called:**
A) Coenzyme B) Prosthetic group C) Activator D) Apo enzyme

25. **Optimum pH value for the working of pancreatic lipase is:**
A) 4.50 B) 7.60 C) 2.00 D) 9.00

26. **The view that active site of an enzyme is flexible and when a substrate combines with it, cause changes in enzyme structure is known as:**
A) Lock & key model
B) Induce fit model
C) Sliding filament model
D) Specificity model

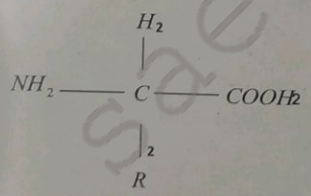
27. **All co-enzymes are derived from:**
A) Proteins B) Nucleic acids C) Carbohydrate D) Vitamins

28. **The most common respiratory substrate as a source of energy is:**
A) Glucose B) Sucrose C) Fructose D) Insulin

29. **The simplest monosaccharide containing keto group is:**
A) Glyceraldehyde B) Dihydroxyacetone C) Glucose D) Ribose

30. **If the genetic code is made of three nucleotides, then total possible genetic codes will be:**
A) 4 B) 20 C) 64 D) 61

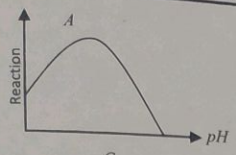
31. **An amino acid molecule has the following general structure:**

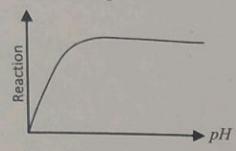


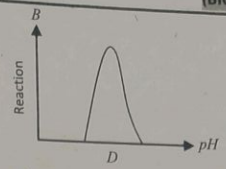
Which two of the groups combine to form a peptide link?
A) 1 and 2 B) 1 and 3 C) 2 and 3 D) 2 and 4

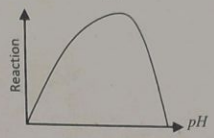
32. **Which of the following does not contain amino acids?**
A) Carbonic anhydrase
B) Glycogen
C) Haemoglobin
D) Insulin

33. **Which one of the graphs below shows the effect of pH on the reaction velocity of a typical enzyme?**

A)


B)


C)


D)


34. **The inference of which of the following is colourless with iodine solution?**
A) Starch B) Glycogen C) Cellulose D) Amylose

35. **Cholesterol is a precursor of steroid _____.**
A) Protein B) Hormones C) Enzyme D) Amino acid

36. **Sucrose is**
A) Reducing sugar
B) Non-reducing sugar
C) Monosaccharide
D) Reducing, disaccharide

37. **Select the one which show characteristics like polymer of beta glucose, 1,4-glycosidic linkage?**
A) Glycogen B) Amylopectin C) Cellulose D) Amylose

38. **Choose one which is chemically protein?**
A) Serine B) Chitin C) Silk D) Amylose

39. **Which of the following physical property is correct about lipids?**
A) On basis on melting points they are divided into fats and oils
B) Neural tissues are made up of simple lipids only
C) Phospholipids are never form part of cell membrane
D) Lipids are strictly macromolecule

40. **Amino group, hydrogen & (-COOH) are _____ in amino acids.**
A) Permanent in some and temporary in others
B) Permanent in acidic and temporary in basic amino acids
C) Permanent in basic and temporary in acidic amino acids
D) The permanent groups

41. **Fatty acid with higher melting point and is more soluble in organic solvent is**
A) Acetic acid
B) Butyric acid
C) Palmatic acid
D) Both A and B have more than C

42. **Select the molecular formula of lactose.**
A) $C_{11}H_{22}O_{11}$ B) $C_{12}H_{22}O_{11}$ C) $C_{12}H_{24}O_{12}$ D) $C_{11}H_{24}O_{12}$

43. **Protein acts as a**
A) Enzyme B) Receptor C) Antibody D) All

44. **Solar energy used for synthesizing 100 gm of glucose**
A) 717.6 kcal B) 7.176 kcal C) 71.76 kcal D) 7176 kcal

45. **Protein is described by biologists at _____ structural levels**
A) 1 B) 2 C) 3 D) 4

46. Except one, all carbon atoms in a monosaccharide have the following group.
A) Hydroxyl group
B) Amino group
C) Aldehydic group
D) Aldehydic group and ketonic group

47. **Select the following which is hexoses**
A) Ribose B) Erythrose C) Glucoheptose D) Galactose

48. **Lipids contain double the amount of energy as compared to same amount of carbohydrates because of high proportion of**
A) C – C bonds B) C – H bonds C) C – O bonds D) C – N bonds

49. **Which of the following statement is incorrect for fats containing unsaturated fatty acids?**
A) They are lighter than water
B) They contain double bonds
C) They are usually solid at room temperature
D) Their specific gravity is less than one

50. **Which of the following act as a genetic material?**
A) DNA+lipids B) RNA+protein C) Lipids+protein D) DNA+RNA

51. **All of the following are included in waxes except**
A) Alkanes with carbons (C_{24} to C_{34})
B) Alcohols
C) Esters of long chain fatty acids
D) Ketones

52. **DNA contains**
A) Ribose B) 3′ deoxyribose C) 5′ deoxyribose D) 2′ deoxyribose

53. **Which of the following is correct about DNA?**
A) Double helical structure in which two strands of polynucleotide runs anti-parallel
B) Covalent-bond is formed by Sugar-Phosphate-Sugar chain
C) N-bases projected more or less perpendicular to back bone and faces inside
D) All

54. **The most common monomer of carbohydrates is a molecule of**
A) Sucrose B) Lactose C) Maltose D) Glucose

55. **Which one is correct?**
A) $E + S \rightarrow ES \rightarrow EP \rightarrow EP$
B) $E + S \rightarrow ES \rightarrow EP \rightarrow E + P$
C) $E + S \rightarrow ES \rightarrow EP \rightarrow E - P$
D) $E + S \rightarrow ES \rightarrow EP \rightarrow E - P$

56. **Inhibition of succinate dehydrogenase by malonate is an example of**
A) Non – competitive inhibition
B) Negative feed back
C) Allosteric inhibition
D) Competitive inhibition

57. **One of the following cannot be hydrolyzed into simple carbohydrates.**
A) Monosaccharides
B) Oligosaccharides
C) Polysaccharides
D) Lactose

58. **Phosphatidic acid is composed of**
A) Glycerol + 2 Fatty acid + Phosphoric acid
B) Glycerol + Fatty acid + Phosphoric acid+ N-base
C) 2 Glycerol + Fatty acid + Phosphoric acid
D) Glycerol + Fatty acid + 2 Phosphoric acid + N-base

59. **Optimum pH of pancreatic amylase is**
A) 9.70 B) 9.00 C) 4.50 D) 2.00

60. **ES complex is converted into product by :**
A) Cofactor B) Catalytic site C) Coenzymes D) Binding site

61. **The specificity of a protein depends upon**
A) Quantity in which it is present in the system

B) Other proteins present in the system
C) Linear sequence of amino acid molecules
D) Time of its synthesis

62. **The inhibitor of which kind can be neutralized by increasing substrate concentration?**
A) None competitive B) Competitive C) Irreversible D) Reversible

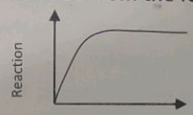
63. **The most abundant protein is the plant world is found in**
A) Root hairs B) Chloroplast C) Mitochondria D) Virus

64. **The tertiary structure of a protein is the**
A) Bonding together of several polypeptide chains by week bonds
B) Order in which amino acids are joined in peptide chain
C) Twisting of a peptide chain into an alpha helix
D) Three dimensional shape

65. **The active site of an enzyme:**
A) Never changes
B) Forms no chemical bond with substrate
C) Determines, by its structure, the specificity of the enzyme
D) Looks like a lump projecting from the surface of an enzyme

66. **Enzyme denaturation means ---------- of enzyme.**
A) Rapid B) Moderate C) Slow D) Inactivity

67. **What can be concluded from the following graph?**



A) Reaction rate decreases with increase the enzyme conc.
B) Reaction rate increases with decrease in enzyme conc.
C) Reaction rate remains constant for product formation.
D) Reaction rate increase with increase in enzyme conc.

68. **The first microbe to have the genome completely sequenced is:**
A) Escherichia coli C) Saccharomyces cervisiae
B) Haemophilis influenza D) Spirochete Bacterium

69. **In RNA_____sugar is present.**
A) Ribose B) 2–deoxyribose C) 3deoxyribose D) 1,2 dideoxyribose

70. **Major portion of RNA in cell is:**
A) mRNA B) rRNA C) tRNA D) Both A & C

71. **Which is not a nitrogenous base?**
A) Adenine B) Cytosine C) Guanine D) Thymidine

72. **In RNA, uracil complementary base pairs with:**
A) Adenine B) Guanine C) Cytocine D) Thymine

73. **150 nucleotides of mRNA can code _____ amino acids in protein.**
A) 450 B) 350 C) 150 D) 50

74. **The first protein to be sequenced was:**
A) Hemoglobin B) Myoglobin C) Insulin D) Thrombin

75. **In sickle cell hemoglobin the change occurs at _____ position of β chain in protein.**
A) 1st B) 2nd C) 3rd D) 6th

76. The denaturation of protein actually disrupts its _____ structure.
A) Primary B) Secondary C) Tertiary D) Quaternary

77. All are fibrous proteins except:
A) Silk B) Antibodies C) Fibrin D) Keratin

78. Types of amino acids found to occur in cells and tissues are:
A) 20 B) 25 C)170 D) 3000

79. Globular proteins are soluble in:
A) Aqueous alcohol
B) Solutions of acids and bases
C) Salt solution
D) All of these

80. The specific properties of proteins are determined by
A) Sequence of amino acids
B) Shape of molecule
C) Number of amino acids
D) All of these

81. In α-helix, each turn of helix contains amino acids:
A) 2.6 B) 3.6 C) 4.6 D) 5.6

82. Carbon combines with nitrogen in amino acid linkages to form:
A) Covalent bonds B) Peptide bonds C) Ionic bonds D) Glycosidic bonds

83. The most abundant molecule in the bodies of all the organisms is the:
A) Protein B) Lipid C) Water D) Carbohydrates:

84. Ionic substances when dissolved in water, dissociate into:
A) Positive ions
B) Negative ions
C) Positive and negative ions
D) Neutral ions

85. The specific gravity of lipids is:
A) 0.5 B) 0.8 C) 1.0 D) 1.2

86. The number of OH groups in glucose is:
A) 4 B) 5 C) 6 D) 7

87. Unsaturated fatty acids may have _____ double bonds.
A) 1 – 4 B) 2 – 8 C) 1 – 6 D) 2 – 10

88. The major source of solid fats are:
A) Plants B) Animals C) Bacteria D) Eukaryotes

89. Which is not a nitrogenous base?
A) Choline B) Lecithin C) Ethanolamine D) Serine

90. FAD (Flavin adenine dinucleotide) is a/an
A) Coenzyme B) Activator C) Prosthetic group D) Lipid

CHAPTER 03

VARIETY OF LIFE

COURSE CONTENT

- Kingdoms: Protoctista, Fungi, Plantae and Animalia
- Viruses: Structure of Viruses
- AIDS: Causative Agent, Modes of Transmission and Prevention & Control

VIRUSES

- At the time of Louis Pasteur (1822 – 1895) and Robert Koch (1843 – 1910), the word **virus** was understood as a poison that caused disease and death.
- Now viruses are known as particles of nucleic acid with a protein coat. They replicate in living cells and cause many diseases such as **influenza, hepatitis, small pox and AIDS**.
- The word virus is derived from Latin word venome which means poisonous fluid. Virus can be defined as: **Non-cellular infectious agent which contain either RNA or DNA, enclosed by proteinaceous coat and reproduce only in the living cells.**
- Viruses use **biosynthetic machinery** of the host to make their materials and then transfer to other cells.
- **Study of virus is known as virology.**
- The first infectious disease against which prevention was developed was a viral disease.
- Charles Chamberland (1884) found that bacteria cannot pass through porcelain filters.
- Rabies is a disease which is transferred to human by bites of dogs, foxes, cats, bats and other animals.
- In 1892, Ivanowski discovered that the agent which caused **tobacco mosaic disease** (TMD) was filterable.
- Stanley (1935) crystallized the **tobacco mosaic virus** (TMV).
- Viruses are small infections agents and can be seen under electron microscope. **They range in size from 250 nm of Poxviruses to 20 nm of Parvoviruses.**
- Viruses are **10 to 1000 times** smaller than bacteria. So they can pass through the pores of filter, from which bacteria cannot pass.
- **Viruses cannot grow on artificial media.** They can reproduce in animal cells, plant cells or in microorganisms. Here they reproduce by replication (a process by which many copies or replicas of virus are formed). Therefore the viruses are obligate intracellular parasites.
- Viruses have no metabolic machinery for the synthesis of their nucleic acid and protein. They depend on the host cell to complete vital functions.
- They can cause disease in the host during reproduction.

- They are generally resistant to many antibiotics such as penicillin, streptomycin and others.
- The complete mature and infections particle is known as virion.
- Capsid gives definite shape to virion.
- Capsid is made up of protein subunits known as **capsomeres. (162 capsomeres in the capsid herpes virus, 252 capsomeres in the capsid of adenovirus which cause some common colds).**

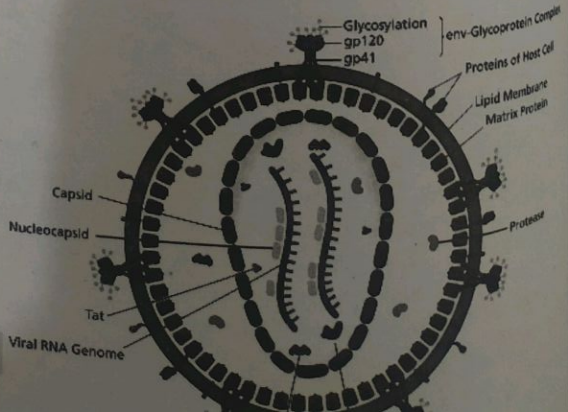
A) VIRAL DISEASES

DISEASE	VIRUS	SYPTOMS	IMMUNIZATION
Small pox	Pox virus (DNA enveloped virus)	Raised fluid-filled vesicles > Pustules > Pocks (form pitted scars)	Vaccination
Herpes Simplex	Herpes virus (DNA enveloped virus)	Vascular lesions in epithelial layers of ectodermal tissue. Most commonly in mouth, lips and skin sites.	Vaccination
Influenza	Influenza virus (RNA enveloped virus)	Running nose, headache, fever, sore throat	Vaccination not so much effective
Measles	RNA enveloped virus (Paramyxovirus)	Fever, runny nose, cough, red eyes, red flat rashes on skin	Auto-immunity, Vaccination
Mumps	RNA enveloped virus (Paramyxovirus)	Fever, muscle pain, headache, painful swelling of parotid glands	Auto-immunity, Vaccination
Poliomyelitis	Polio virus (RNA non-enveloped virus, in spherical capsid). Smallest known virus	Paralysis of limbs	Vaccination

B) RETROVIRUSES & AIDS

RETROVIRUSES

- Retroviruses are ***associated with*** tumor production in animals like fowl, rodents and cats.
- Human immunodeficiency virus ***(HIV)*** which causes acquired immunodeficiency syndrome (AIDS) a retrovirus.
- They are ***spherical, 100nm*** in diameter, ***enveloped*** by host plasma membrane, contains single stranded RNA.
- May be ***non-specific*** in their action but usually infect those cells containing specific receptors e.g. in HIV infect ***CD4+*** human W.B.C. (helper T-lymphocytes)



- ***Reverse transcriptase*** is a special enzyme which can convert single stranded RNA genome into double stranded viral DNA, which not only infect the host cell but also incorporate into host genome as a provirus that can pass on to progeny cells. In this way normal cells become cancer cells.

ACQUIRED IMMUNODEFICIENCY SYNDROME

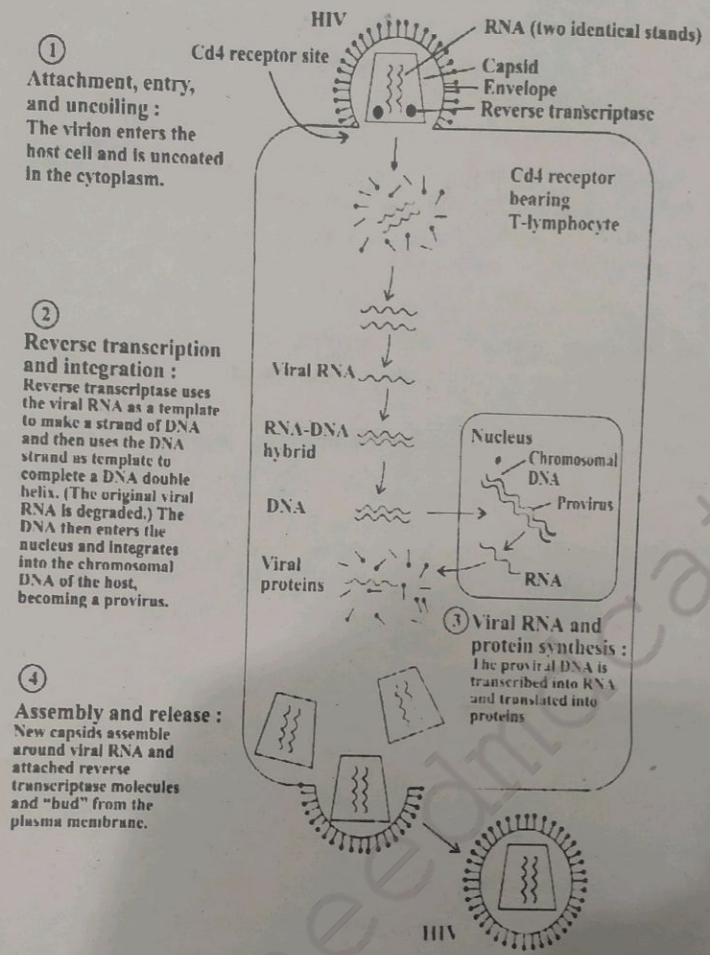
- Acquired immunodeficiency syndrome (AIDS) ***first reported*** in young homosexual males, having one or more complex symptoms like severe pneumonia, vascular cancer, sudden weight loss, swollen lymph nodes and immune deficiency or decreased immune functions.
- AIDS is caused by ***HIV*** a retrovirus, which is ***host specific***, since it infects and multiplies in monkeys but does not cause disease.

Mode of Transmission

- By intimate ***sexual contact*** (virus present in body secretions and blood, which gets entry in recipient blood from minor wear and tears, more common in homosexuals).
- Contact with blood and breast feeding.
- ***Prick*** of an infected needle or surgical instruments (problem for health care providers).
- HIV also infects cells of ***CNS***.

Prevention

- Avoid sharing syringes.
- Use of sterile needles, syringes & surgical instruments.
- Avoid prohibited sexual contacts.
- Screening of blood and blood products before transfusion.
- Vaccine has been synthesized and administered on experimental basis.



LIFE CYCLE OF BACTERIOPHAGE

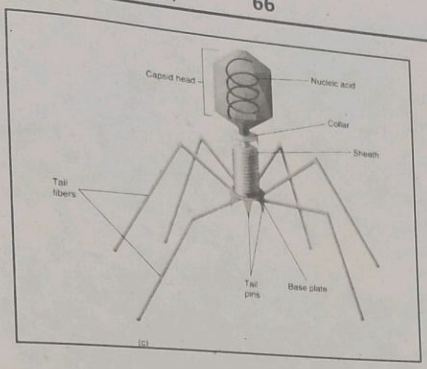
The best studied phage virus is that which infect E. coli, and is called T phage (t for type), and among them T_2 and T_4 phages mainly used in phage studies.

T_4 resembles a ***tadpole***, with a head and a tail.

Its***head***is an elongated pyramidal, hexagonal, prism shaped structure, containing DNA and to which straight tail is attached.

Phage Tail is more complex than head, consisting of an inner proteinaceous core, enclosed in a sheath, made of another protein, to one end of which there is ***collar*** and to the other ***end plate, Six tail fibers*** are attached with the tail.

Phage volume is ***1/1000*** of its host i.e. *E. coli*.



STEPS OF LIFE CYCLE

(1) Attachment/ Adsorption

- First step is the attachment (adsorption) to the host cell at receptor site on the cell wall of bacterium. During attachment, weak chemical union between virion and receptor site takes place.

(2) Penetration

- Next step is penetration; the tail releases the enzyme lysozyme to dissolve a portion of bacterial **cell wall.** The tail sheath contracts and tail core is forced into the cell through cell wall and cell membrane.

(3) Injection

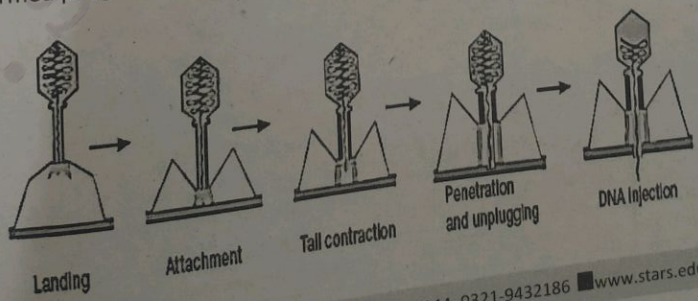
- Third step is injection of viral DNA in bacterial cell. The proteins coat, which forms the phage head and tail structure of virus remains outside the cell.

(4) Replication Process

- Two types of cycles are usually seen i.e. lytic and lysogenic cycle.

LYTIC CYCLE

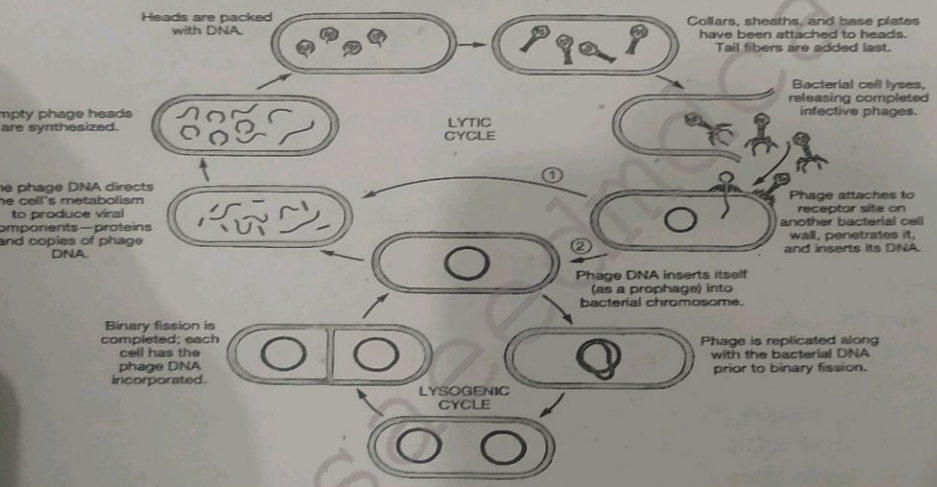
- Viral DNA takes control of the host's biosynthetic machinery.
- It induces the host cell to synthesize necessary viral components (DNA & Proteins) and start multiplying.
- **About 25 minutes** after initial infection, approximately 200 new bacteriophages are formed.
- Bacterial cell bursts i.e. it undergoes lysis.
- Newly formed phages are released to infect the bacteria and another cycle begins.



GENIC CYCLE

- Viral DNA, instead of taking over the control of host's machinery, becomes incorporated into the bacterial chromosome. Phage in this dormant state is called **prophage**and this process is called **lysogeny.**
- Bacterium continues to live and reproduce normally. Viral DNA being the part of bacterial chromosome passes to each daughter cell in all successive generations.
- Sometimes Viral DNA gets detached from the host's chromosome and lytic cycle starts. This process is called **Induction.**

FEATURE	LYTIC CYCLE	LYSOGENIC CYCLE
Virus	Lytic or virulent phage	Lysogenic or temperature phage
Relationship	Master – Slave relation	Host – Guest relation
Effects	Infectious Cycle	Non-infectious cycle
Viral DNA	Takes Control	Integrated
Bacterial DNA	Destroyed	Remains intact



DISEASE	VIRUS	SYMPTOMS	IMMUNIZATION
Hepatitis A (Infectious)	RNA non-enveloped virus	Acute infection (Nausea, vomiting, diarrhea, jaundice)	Auto-immunity, Vaccination
atitis B (Serum)	DNA enveloped virus	Acute (vomiting, yellowish skin, tiredness, dark urine, abdominal pain) & chronic (No symptoms, live cirrhosis & liver cancer)	Vaccination
titis C (Infusion)	RNA enveloped virus	Chronic (occasionally fever,	Vaccination NOT

		dark urine, abdominal pain, yellow skin) with cirrhosis & liver cancer.	available
Hepatitis E	RNA non-enveloped virus	Acute infection (Nausea, vomiting, diarrhea, jaundice)	Auto-immunity, Vaccination
AIDS	RNA enveloped virus	Opportunistic infections, Swollen lymph nodes	Vaccination NOT available

TWO TO FIVE KINGDOM CLASSIFICATION SYSTEM

FIVE KINGDOM CLASSIFICATION SYSTEM

- Five kingdom system was proposed by Robert Whittaker.
- Organisms were chiefly assorted in five groups based on their *mode of nutrition* i.e., photosynthesis, absorption, and ingestion.

Kingdom	Nutrition	Cells	Nature	Locomotion	Cell Wall	Example
Monera	Autotrophic	Unicellular	Prokaryote	Can move	Peptidoglycan / Murein	Bacteria, Cyanobacteria etc.
Protista	Autotrophic	Mostly unicellular/ simple multicellular	Eukaryote	Can move	Mostly cellulose	Euglena, Amoeba ,Paramecium etc.
Fungi	Absorptive heterotrophic	Multicellular	Eukaryote	Can't move	Chitin	Penicillium, Mushrooms etc.
Plantae	Photosynthetic autotrophs	Multicellular	Eukaryote	Can't move	Cellulose	Mosses, Ferns, Angiosperms etc.
Animalia	Ingestive heterotrophic	Multicellular	Eukaryote	Can move	No	Birds, reptiles etc.

KINGDOM PROTISTA

- It consists primarily aquatic eukaryotic unicellular, colonial or simple multicellular organisms.
- All protists evolved from prokaryotes.
- It contains four major groups, single cell protozoans, unicellular algae & multicellular Algae, slime molds and water molds.
- Margulis and Schwartz have listed 27 phyla to accommodate this diverse assemblage of organisms

PROTOZOA: ANIMAL – LIKE PROTISTS

Common Name	Form	Existence	Structure	Examples
Amoeba	Unicellular	Free living	Pseudopodia (False feet) cytoplasmic projections.	Entamoebahistolytica (Amoebic dysentery in humans.)
Zooflagellates	Unicellular, some colonial	Free living, Parasitic or symbiotic.	One (usually at anterior end) or more flagella.	Trichonymphas (symbiotic in termite's gut) Trypanosoma (African sleeping sickness) Choanoflagellates Euglena.
Ciliates	Unicellular	Free living	Cilia Pellicle Contractile vacuole Diploid micronuclei Polyploidy Macronucleus	Paramecium, Vorticella, Stentor.
Actinopods	Unicellular	Free living	Pseudopodia Siliceous shell	Radiolarians
Foraminiferans	Unicellular	Free living	Pseudopodia Calcareous shell Chalk & lime stone	Forams
Apicomplexans	Unicellular	Parasitic	None, flexing.	Plasmodium (malaria)

THE ALGAE : PLANT LIKE PROTISTS

Algae (singular alga) are photosynthetic protists, carrying out probably **50 to 60 percent** of all the photosynthesis on earth (plants account for most of the rest).

Algae differ from the plant in their sex organs which are unicellular and the zygote is not protected by the parent body. A plant zygote, on the other hand, grows into a multicellular embryo that is protected by parental tissue.

Algae exhibit a remarkable range of growth forms. Some are unicellular; others are filamentous. Filaments are composed either of distinct cells or coenocytes (multinucleate structures that lack cross – walls); still others (e.g. seaweeds) are multicellular and intricately branched or arranged in leaf – like extensions. **A body which is not differentiated into true roots, stems and leaves and lacks xylem &**

phloem is called a thallus.

- In addition to green chlorophyll a, yellow and orange carotenoids, which are photosynthetic pigments are found in all algae, other algal phyla possess a variety of other pigments (such as **xanthophylls and phycoerythrin)** that are also important in photosynthesis. Classification into phyla is largely based on their pigment composition.
- **Algal life cycles show extreme variation, but all algae except members of the phylum Rhodophyta (red algae) have forms with flagellated motile cells in at least one stage of their life cycle.**
- Almost all algae are aquatic. When actively growing, algae are restricted to damp or wet environments, such as the ocean; freshwater ponds, lakes, and streams; hot springs: ice; moist soil, trees, and rocks.

Classification of the photosynthetic Protoctists

Phylum	Common name	Form	Locomotion	Pigments	Examples
Euglenophyta	Euglenoids	Unicellular	Two flagella one long one short	Chl. *a*, Chl. *b* Carotenoids	*Euglena*
Pyrrophyta	Dinoflagellates	Unicellular	Two flagella	Chl. *a*, Chl. *c* Carotenes including Fucoxanthin	*Gonyaulax*, *Ceratium*
Chrysophyta	Diatoms	Usually unicellular	Usually none	Chl. *a*, Chl. *c* Carotenes including Fucoxanthin	Diatoma, Frequilaria Pinnularia
Phaeophyta	Brown algae	Multicellular	Two flagella on reproductive cells	Chl. *a*, Chl. *c* Carotenes including Fucoxanthin	Fucus, Macrocystis
Rhodophyta	Red algae	Multicellular or unicellular	None	Chl. *a*, carotenes	Chondrus Polysiphonia
Chlorophyta	Green algae	Unicellular. Colonial, multicellular	Most have flagella	Phycoerythrin Chl. *a*, Chl. *b*, carotenes	Chlorella, Ulva, Acetabularia Spirogyra

FUNGUS – LIKE PROTISTS

- Some protists superficially resemble fungi in that they are not photosynthetic and some have bodies formed of threadlike structures called hyphae.

- Many of these protists have centrioles and produce cellulose as a major component of their cell walls whereas fungi lack centrioles and have cell walls of chitin. Two major groups of fungus – like protists are Slime molds and water molds (oomycotes).

(i) Slime molds or Myxomycota

- **The feeding stage of a slime mold is a plasmodium, a multinucleate mass of cytoplasm that can grow to 30 cm (1 ft.) in diameter.**
- The plasmodium, which is slimy in appearance, streams over damp, decaying logs and leaf litter. It often forms a network of channels that cover a large surface area. As it creeps along, it ingests bacteria, yeasts, spores and decaying organic matter.
- During unfavourable condition, slime mold forms resistant haploid spore by meiosis within stalked structures called sporangia. When conditions become favourable again, spores germinate into biflagellated or amoeboid reproductive or swarm cells which being diploid.
- **The plasmodial slime mold Physarum polycephalum is a model organism that has been used to study many fundamental biological processes, such as growth and differentiation, cytoplasmic streaming, and the function of cytoskeleton.**

ii. Water molds or Oomycotes

- Oomycotes show close relations with the fungi and have a similar structure, but are now regarded as more ancient group.
- Their cell walls contain cellulose, not chitin. Their hyphae are **aseptate** (without cross walls). Oomycotes include a number of pathogenic organisms, including Phytophthorainfestans, which have played infamous roles in human history.
- **Phytophthora infestans was the cause of Irish potato famine of the 19th century. It causes a disease commonly known as late blight of potatoes. Because of several rainy, Cool summers in Ireland in the 1840's, the water mold multiplied unchecked, causing potato tubers to rot in the fields. Since potatoes were the staple of Irish peasants' diet, many people (250,000 to more than 1 million) starved to death. The famine prompted a mass migration out of Ireland to such countries as the United States.**

FUNGI

- Fungi are eukaryotes, non-motile absorptive heterotrophs.
- The body of the fungus is called **mycelium,** consists of long, slender, branched tubular thread like filaments called **hyphae.**
- Chitin in their cell wall is more resistant to decay than are cellulose and lignin which make up plant cell wall.
- Hyphae may be septate or non-septate. Septate hyphae are divided by cross-walls called septa into individual cells containing one or more nuclei.
- Septa of many septatehyphae have a pore through which cytoplasm flows from cell to cell.
- **Non-septate hyphae** lack septa and are not divided into individual cells; instead these are in the form of an elongated multinucleated large cell. Such hyphae are called **coenocytic hyphae,** in which the cytoplasm moves effectively, distributing the materials throughout. These are always multinucleate.
- Hyphae may be packed together and organized to form complex reproductive structures such as mushroom, puff balls, morels etc.
- **Yeast are non-hyphal and unicellular fungi.**

- All fungal nuclei are haploid except for transient diploid zygote that forms during sexual reproduction.
- All parts of the fungus growing through the substrate ate metabolically active. Extensive spreading system of hyphae provides enormous surface area for absorption.
- They show a characteristic type of mitosis, called nuclear mitosis. During nuclear mitosis, nuclear envelope does not break: instead the mitotic spindles form within the nucleus and nuclear membrane constricts between the two clusters of daughter chromosomes.

REPRODUCTION IN FUNGI

Fungi can reproduce asexually as well sexually.

ASEXUAL REPRODUCTION

Asexual reproduction takes place by means of spores, conidia, fragmentation and budding.

✓ **Spore formation**

- Spores are common mean of reproduction in fungi.
- Spores are produced inside the reproductive structures called sporangia, which are cut off from the hyphae by complete septa.
- Spores may be haploid, non-motile and not needing water for their dispersal.
- These are small in size, produced in very large number and dispersed by wind to great distances.
- Spores may also be dispersed by insects and many other small animals and by rain splashes.

✓ **Conidia Formation**

- Conidia are non-motile, asexual spores which are cut off at the end of modified hyphae called conidiophores, and not inside the sporangia, usually in chains or clusters.
- They may be produced in large number, can survive for weeks.

✓ **Fragmentation**

- Fragmentationis simple breaking of mycelium of some hyphal fungi, each broken fragment giving rise to a new mycelium.

✓ **Budding**

- Unicellular yeasts reproduce by budding.
- It is an asymmetric division in which tiny outgrowth or bud is produced which may separate and grow.

SEXUAL REPRODUCTION

- During sexual reproduction in fungi, hyphae of two genetically different but compatible mating types come together, their cytoplasm fuse followed by nuclear fusion.
- **Karyogamy** is the fusion of nuclei while **plasmogamy** is the fusion of cytoplasm.
- In Basidiomycetes and Ascomycetes, **karyogamy does not take place immediately after plasmogamy**; instead the two genetic types of haploid nuclei from two individuals may coexist and divide in the same hyphae for most of the life of the fungus. Such hyphae having two different genetic types are called **dikaryotic or heterokaryotic.**
- Different groups of fungi produce different types of haploid sexual spores, such as basidiospores and ascospores.

CLASSIFICATION OF FUNGI

- Classification of fungi into four main groups is based primarily on the type of their sexual reproductive structures and methods of reproduction.

CLASSIFICATION OF FUNGI

Phylum (group)	Typical examples	Sexual reproduction	Asexual reproduction	Hyphae
Zygomycota (Zygomycetes)	Rhizopus, (Black bread mold) Pilobolus (spitting fungus)	Zygospores	Non-motile spores form in sporangia	Non-septate, multi nucleate
Ascomycota (Ascomycetes or sac – fungi)	Yeasts, morels, truffles, powdery mildews, molds	Ascospores inside sac – like asci	Conidia cut off from tips of conidiophores	Septate, lengthy dikaryotic phase.
Basidiomycota (Basidiomycetes or club – fungi)	Mushrooms, rusts, smuts, puff balls, bracket fungi	Basidiospores borne on club shaped basidia	Uncommon	Septate, lengthy dikaryotic phase
Deuteromycota (Deuteromycetes /Imperfect fungi)	Aspergillus, penicillium, Alternaria	Sexual phase has not been observed	Conidia	Varied

LAND ADAPTATIONS OF FUNGI

- They are well adapted to live on land due to lack of flagellated cells, non-motile spores and conidia efficient dispersal by wind, thick-walled zygote and other resistant structures.
- Many fungi are more tolerant than are bacteria to damage in hyperosmotic surroundings. Many can tolerate temperature extremes **– 5°C** below freezing and **50°C** or more. Now you can tell why molds (e.g. Penicillium) can grow on oranges and jelly kept in a refrigerator, while generally bacteria cannot.

USEFULLNESS AND HARMFULLNESS OF FUNGI

Fungi are important both ecologically and economically.

Ecological Importance

- Fungi are important group of ***decomposers and symbionts***.
- They play an important role in ***recycling of inorganic nutrients*** in the ecosystem.
- ***Mycorrhizal fungi*** improve the growth of plants, with which 95% of vascular plants are associated.
- ***Lichen*** growing on rocks, break rocks, setting stage for other organisms during the course of ecological succession.
- Lichens being sensitive to pollution are ***good bio indicators*** of air quality.
- Some fungi are also used for ***bioremediation***.

Commercial Importance

Ecological Gains Due to Fungi

- About ***200 species*** of ***mushrooms*** are ***edible***.
- ***Morels*** (Morchella esculenta) and truffles are edible fungi.
- Poisonous mushrooms are called ***toadstools*** e.g. death cap/death angel (Amanita) and Jack O' lantern mushroom.
- ***Reindeer moss*** (lichen) is used as food for reindeers.
- ***Yeasts*** are used in production of bread and liquor.
- ***Penicillium*** species are used for giving flavor, aroma and characteristics colour to some cheese

- Some species of ***Aspergillus*** are used for fermenting soya sauce and soya paste from soya bean.
- ***Citric acid*** is obtained from some Aspergillus species.
- ***Penicillin*** is first antibiotic, which was discovered by A. Fleming in ***Penicillium notatum***(fungus).
- ***Lovastatin* is used for lowering blood cholesterol.**
- ***Cyclosporine* is used to relieve transplantation for preventing transplant rejection.**
- ***Ergotin* is used to relieve migraine (one kind of headache).**
- ***Griseofulvin* is used to inhibit fungal growth.**
- ***Yeast*** were the first eukaryotes to be used by genetic engineers.
- First functional ***artificial chromosome*** was made in Saccharomyces cervisiae.
- Pink bread mold ***Neurospora*** has been used in genetic research.

Ecological Losses Due to Fungi

- Powdery mildews (on grapes, rose, wheat), ergot of rye, red rot of sugar cane, potato wilt, cotton root rot, apple scab and brown rot of peaches, plums, apricots and cherries are common plant diseases caused by fungi.
- ***Ringworm and athlete's foot*** are superficial fungal infections caused by certain imperfect fungi.
- ***Candida albicans,***a yeast, causes oral and vaginal thrush (candidiasis or candidosis).
- ***Histoplasmosis*** is a series infection of lungs caused by inhaling spores of a fungus, which is common in soil contaminated with bird's fesses.
- ***Aspergillus fumigatus*** causes ***asperillosis*** in persons with defective immune system (e.g. AIDS).
- Some strains of ***Aspergillus*** produce carcinogenic mycotoxins, called ***aflatoxins***.
- ***Ergotism*** is caused by eating bread made from purple ergot-contaminated rye flour. Ergot causes nervous spasm, convulsion, psychotic delusion and gangrene.
- ***15-50%* of world's fruit is lost each year due to fungal attack.**
- ***Wood-rotting fungi*** destroy living trees and structural timber.
- ***Bracket/shelf fungi*** cause lot of damage to stored cut lumber as well as stands of timber of living trees.
- Pink yeast ***Rhodotorula*** grows on shower curtains and other moist surfaces.

KINGDOM PLANTAE

Bryophyta (non-vascular Plants)

- Amphibians of Plants
- Alternation of Heteromorphic Generation.
- Fertilization in water.
- Vascular system absent, gametophyte dominant.
- Sporophyte attached to gametophyte: Homosporous.
- **Land adaptations**
  - Reducing the exposed surface area.
  - Development of photosynthetic tissue
  - Efficient absorption of water
  - Heterogamy
  - Multicellular sex organs
  - Retention of embryo in female reproductive body
  - Alternation of generation

Classification

Hepaticopsida

- Liverworts
- 900 species
- Plant body; Gametophyte
- Plant body may be thaloid
- Attached to soil by rhizoids, (Marchantia)
- Upright falsy leaf(Porella)
- Special branches on gametoohyte
- Anthridiophore] Marchantia
- Archigoniophore]
- **Examples:**
  Marchantia
  Porella

Bryopsida

- Musci,Mosses
- Archigonia]
- Anthredia]
  - Different Branch Same plant Funaria
  - Different Branch Different Plant Polytrichum
- Paraphyses
- Protonema
- **Examples:**
  Funaria
  Polytrichum

Anthocerotae

- Horn worts
- Anthridia+Archegonia partly sunken in Gametophyte
- Meristematic Tissues at junction
- **Examples:**
- Anthoceros

Tracheophyta (Vascular Plants)

- Root, stem and leaves
- Vascular system
- Protected sporangia
- Pollen tube
- Flower + tube
- Heteromorphic alternation of Generation.

Classification

Psilopsida(Psilophyta)

- Wisk Fern
- Rootless sporophyte
- Stem] Rhizome, Arial parts
- Earliest group of vascular plants
- Gametophyte thaloid
- **Examples:**
  Extinct...
  Heterophyton
  Psilophyton
  Cooksonia
  Living
  Psilotum] Mycorhizae
  Tmesipteris]

Evolution of leaf

- 350M years ago
- cooksonia,Naked Stem without leaf
- Lycopods formed true leaves and roots
- Microphyll
- Megaphyll
- **Evolutionary Steps**
  - Overtopping
  - Planation
  - Fussion/ Webbing

Lycopsida

- Club mosses
- Arrangement of leaf=Spiral
- Also called Mosses/Spike mosses
- Spike shape Stobilli
- Homo/Heterospory
- **Examples:**
  Lycopodium (One kind Sporagia)
  Selegenella (Two Kind Sporangia, Heteromorphy)

Sphenospsida

- Horsetail
- Arthrophytes
- Sporangiophore arranged to form Stobili
- **Example**
  Equisetum

Pteropsida (Fern, Seed Plants)

Classes

Filicineae (Fern)

- Foliar
- sporangia attached to frond.
- Frond(Leaves)
- circinate vernation
- some are epiphytic
- **Examples**
  Dryopteris, Pteridium, Adiantum, Pteris
- **Adiantum**
  - Herb
  - Strip(Stalk) Black
  - Rachis
  - Fibrous adventitious root.
  - Sori (group of sporangia)
- **Life cycle**
  - sorus green but when
  - ripe become dark brown
  - sporophyll (leaf bearing sporangia)
  - Edge of capsule:] annulus, 3/4

Evolution of seed

- Occur 390M year ago
- First complete seed 365 M years.
  - Evolution of Heterospory.
  - Retention and germination of Megaspore within megasporangium
  - Development of protective layers. around megasporongium.
  - Reduction to a single funtional megaspore per sporagium
  - Development of an embryo sac within the sporangim
  - Modification of distal end of megasporargim for pollen capture

Class Gymnospermae

- 1/3 of forest
- seed plant
- produce seed but not fruit
- Naked seeded
- Important genera
  Cycas (sago-palm), Pinus(pine), Taxus(yew)
  Picea (Hemlock), Cedrus (deodar), Ginko
- **Pinus**
  - Coniferous Heterosporous
  - Mircrospore --> Male --> small cone
  - Megaspore --> Female --> Large cone
  - Male + Female cone --> same plant
  - Fertilization does not require water
  - Male gametophyte = Mircrogametophyte
  - Female gametophyte = Megagametophyte
  - *Pinus = Domiant diploid sporophyte generation alternates with Inconspicuous hapioid gametophyte generation.*

Class Angiospermae

- closed seeded
- 235000 | 360000 Known species
- **Life cycle**
  - Function of sepal + petal
  - Formation of Male Gametophyte
  - Carpel
  - Formation of Male sporophyte
  - Fertilization
  - Seed formation
  - *Double fertilization*

Plant Familiess

PTO

PLANT FAMILIES

Rosaceae (Rose Family)

100 Genera
2000 Species
Pakistan
29 Genera
213 Species

- **PLANTS:**
  Pyrus(Pear, Peach, crategeous,
  Rosa(Rose), Almond,Pyrus
  Malus(Apple,(Apricot)
  Frageria(Strawberry
- **VEGETATIVE CHARACTERS**
  1. ROOT
  Usually, Tap root with its usual branching.
  2. STEM
  Usually, Green herbaceous,
  cylindrical, small spines are also present.
  3. LEAVES
  Usually, Simple leaves with or without petiole,
  Opposite or alternate.
- **FLORAL CHARACTERS**
  Usually, Complete,actinomorphic,
  perigynous, pentamerous.
  1. CALYX
  Usually, Sometime epicalyx may also be
  present, of variable number, 5 sepals are present,
  Gamosepalous, green, pubescent.
  2. COROLLA
  Usually, 5 petals or multiple of 5 petals,
  polypetalous, aestivation, imbricate,
  shape-rosaceous, full of colour.
  3. ANDROCEIUM
  Usually, Nomerous stamen,ditheous,
  anther, enerted, extrose, dorsi fixed.
  4. GYNOECIUM
  Usually, Monocarpillary or multiple capillary
  with formation of a single compound pistil.
  Ovary perigynous, unilocular two or more
  ovules are present, placentation axile when
  the carpels are many and syncarpous
  INFLORSCENCE
  Usually Racemose
  FLORAL FORMULA
  + , G , K(5) , C(a) , Ax , G1/ (2-5) or x
- **ECONOMICAL IMPORTANCE**
  FRUIT:
  Many famous fruits belong to this
  family for e.g. Apple, pear, peach, e.t.c.
  ORNAMENTALS
  Grown in parks and gardens
  OTHERS
  Branches of Crataegus provide excellent
  walking stick and wood.
  The wood of pyrus pastia is used for
  making tobacco pipes.
  Rose petals are used in making Gul Kand
  and are also used in extraction of an essential
  oil, Rose oil, used as perfume, eye cleaner.

SOLANACEAE (Poatato family), night shade

90 genera
2000 species (Tropical+ Temperate)
Pakistan:
14 genera
52 species

- **PLANTS:**
  Solanum tuberosum(Potato)
  Nicotiana Tobacum(Tobacco)
  Lycopersicum esculentum(Tomato)
  Capsicum frutescens/C.annum(red pepper)
  Atropa belladona
  Datura,Cestrum,Petunia,
- **VEGETATIVE CHARACTERS**
  1-ROOT
  Tap root and branched
  2-STEM
  Herbacious, erect or underground(Potato)
  3-LEAF
  Alternate in vegetative and opposite in floral region
- **FLORAL CHARCTERS**
  1-INFLORESCENCE
  Cyme sometimes helicoids
  2-FLOWER
  Pentamerous,Regular, Actinomorphic, Hypogynous.
  3-CALYX
  Five, united sepals
  4-COROLLA
  Five petals, united, valvate aestivation
  5-ANDROCIEUM
  Five stamens, Inserted on Corolla
  6-GYNOECIUM
  Bicarpellary, Syncarpous (Carpels fused),
  Placentaion axile.
  7-FRUIT
  Capsule Berry or Xanthium.
  8-SEED
  Minute with abundant endosperm.
  FLORAL FORMULA
  + , O , K(5) , A5, C(5) ,
- **ECONOMIC IMPORTANCE**
  Provide drugs and food.
  Some plants are poisonous and other are ornamental.
  Provides food, fodder, drugs and ornamentals.
  1-FOODER
  Solanum tuberosum (Potato)
  Lycopersicum esculentum (Tomato)
  Solanum melangena (Brinjal)
  2-CONDIMENTS
  Fruit of capsicum
  Capsicum frutenscens → Vit. C & A
  3-EDIBLE FRUIT
  Physalis (Cherry,or Rasbhari)
  4-DRUG YIELDING
  Atropa belladonna (atropine)
  Dotura (Deturine)
  Used in severe cold and in eye diseases.
  5-ORNAMENTAL
  Cultivated in gardens
  Petunaia
  Nicotiana
  Cestrum
  Solanum
  6-CIGARETTE MAKING
  Nicotiania tobacum (Tobacco)

FABACEAE (Pea family)

400 genera
9000 species
Pakistan
82 genera
587 species

- **PLANTS:**
  Lathyrus odoratus(Sweet pea)
  Arachis hypogea (Peanut)
  Cicer arietinum (Chick. pea)
  Dalbergia sisso(Shishum)
  Gram,Pea,Beans,Medicago sativa,
  Butea.
- **VEGETATIVE CHARACTERS**
  1-RODTS
  Tap root, branched bearing tubercle
  containing nitrogen fixing bacteria.
  2- STEM
  Herbecious or woody, erect or climber.
  3-LEAF
  Simple or commonly compound
  alternate, stipulate
- **FLORAL CHARACTERS**
  1- INFLORESCENCE
  Racemose, rarely solitary.
  2- FLOWER
  Irregular, zygomorphic, hypogynous.
  3- CALYX
  Five sepals, united
  4- COROLLA
  Five petals, usually free.
  Corolla is papilionaceous (Butterfly shaped).
  In this form the petals are 5, one of them is
  usually large and clawed. This petal is called
  standard or "Vexillum" The two lateral ones,
  which are free are called as "Wings" and two
  anterior inner most fuse to form a boat shaped
  structure called the "Keel" or "Carina".
  5- ANDROCIEUM
  Stamens (9) +1 i.e 9 fuse to form a round sheath
  around the pistil while tenth is free.
  6-GYNOECIUM
  Monocarpellary, ovary unilocular, ovule numerous
  on marginal placenta.
  7-FRUIT
  Legume or pod.
  8-SEED
  EX-albuminous.
  FLORAL FORMULA
  + , G , K(5) , C 1+2+(2) , A(9)+1 , G1
- **ECONOMIC IMPORTANCE**
  Source of high protein food, oil and forage
  ornamental purposes, pulses (Dalls)
  1- FOOD & FORAGE
  Pisum sativum (Pea)
  Medicago sativa alfalfa (Lusan)
  2- FURNITURE & BUILDING PURPOSE
  Butea
  Dalbergia
  3- OIL EXTRACTION
  Arachis hypogea (Peanut/Moongphali)
  4- DYES
  Indigofera tinctoria (Neel)
  Butea monosperma (Yellow dye)
  5-MEDICINAL PURPOSE
  Glycyrrhiza glabra (Cough & cold treatment)
  Clitoria ternatea (Snake bite treatment)
  6- ORNAMENTAL PLANTS
  Lathyrus
  Lupinus
  Clitoria
  Butea
  Abrus precatorious, "Ratti".

CEASELPINIACEAE (Cassia family)

152 genera
2300 species
Pakistan:
16 genra
60 species

- **PLANTS:**
  Tamarindus indisa
  Cassia fistula
  Bauhinia veriegeta
- **VEGETATIVE CHARACTERS**
  ROOT
  Usually, Taproot with nodules and
  primary, secondary and tertiary divisions.
  STEM
  Usually, Climbing stem or erect
  herbaceous or woody, Some plants
  show xerophytic character.
  LEAVES
  Usually, Compound leaves bipinnate, stipulate.
  INFLORESCENCE
  Usually, Racemose.
- **FLORAL CHARACTER**
  Usually, Complete, perigynous,
  zygomorphic, pentamerous.
  CALYX
  5 sepals, polysepalous, imbricate
  or valvate, Green in colour.
  COROLLA
  5 petals, poly petalous, imbricate aestivation.
  ANDROECIUM
  Usually, 10 stamens, polyanderous,
  exerted, extrose.
  GYNOECIUM
  Usually Monocarpillary, perigynous,
  placentational marginal, unilocular with many ovules.
  FLORAL FORMULA
  + , Q , K(5) , C(5) , A10 , G1/
  POLLINATION
  Usually, Cross pollination by insects (entomophilly)
  SEEDS
  Usually, Both endospermic and non-endospermic.
  FRUIT
  Legume pod.
- **ECONOMICAL IMPORTANCE**
  MEDICINAL PLANS
  Amaltas
  Kachnar
  Tamarindus Indica
  ORNAMENTALS
  Parkinsonia
  Bauhinia
  Cassia
  DYES AND STAINING
  Haemotoxylin is obtained from
  haemotoxylon campechianom.
  EDIBLE FRUIT:
  Imli
  FIBER:
  Suitable for paper making
  Cassia alata → ringworm and skin disease

MIMOSACEA (Accacia family)

56 genra
2800 species
Pakistan:
11 genera
49 species
Native
4 genera
18 species

- **PLANTS:**
  Acacia nilotica
  Albizzia lebbek
  Mimosa pudica
  Touch me not
  Prosopis glandulosa
  P.Cineraria
- **VEGETATIVE CHARACTERS**
  1. ROOT
  Usually, Tap root with side branches,
  nodules are present.
  2. STEM
  Usually, Erect and woody stem,
  rarely herbacious; tannin and gums
  may also present.
  3. LEAVES
  Usually, Compound, bipinnate,
  stipule are modified into spines.
  Show sleeping movement or after having a shock.
  INFLORESCENCE
  Mostly, racemose.
- **FLORAL CHARACTERS**
  Usually, Complete, actinomorphic, perigynous,
  pentamerous.
  1. CALYX
  Usually, 5 sepals, gamosepalous, valvate.
  2. COROLLA
  Usually, 5 petals, polypetalous,
  valvate aestivation, small size.
  3. ANDROCEIUM
  Usually, numerous stamens, exerted,
  extrose, basifixed anther.
  4. GYNOECIUM
  Usually, Monocarpillary, perigynous,
  unilocular, placentation marginal,
  many ovules in locule.
  POLLINATION
  Usually, cross pollination by insects (entomophilly).
  SEEDS
  Usually, Non-endospermic or with very
  little endosperm.
  FRUIT
  Usually, It is called legume.
  FLORAL FORMULA
  + , Q , K(5) , C(5) , Aa , G1/
- **ECONOMICAL IMPORTANCE**
  1.WOOD YIELDING PLANTS
  e.g-prosopis
  Acacia species
  Albizzia
  Xylia
  2. ORNAMENTALS
  e.g-Mimosa pudica (chuimoi)
  Australian Acacia
  Neptunia
  3. FOODER
  From leaves of prosopis, Acacia
  Dicrostachys e.t.c.
  4. SOAP POPS
  Acacia concinna pods have (soponim),
  a substance can be used as Soap.
  5. CATECHU (KATHA)
  Piece of hard wood
  6. MEDICINAL USE
  Katha, Siah Kanta, Entada, Acacia senegai
  7. GUMS & DYES
  Katha(Accacia catechu)
  Safed Babul, Sada Babul

POACEAE (Grass family)

600 genera
10000 species
Pakistan:
158 genera
492 species

- **PLANTS:**
  Triticum vulgare(wheat)
  Zea mays(corn)
  Avena sativa(oats)
  Oryza sativa(Rice)
  Bambusa
  Saccharum officinaram(Sugar cane)
  Hordeum vulgare(Barle)
  Secale cereal (rye)
  Penisitum typhodium
  Sorgam valgare
  Agarostis, Poa,Fescuta
  Cymbopogon citratus (Lemon grass)
  Saccharum munja(Rope)
- **VEGETATIVE CHARACTERS**
  1- ROOTS
  Adventitious, fibrous or fascicled.
  2- STEM
  Cylindrical, Conspicuous nodes and
  hollow, although solid stems are also
  found as sugar cane.
  3- LEAF
  Legulate, alternate leaf sheath
  mostly open sessile, lamina narrow
  and ribbon shaped.
- **FLORAL CHARACTERS**
  1- INFLORESCENCE
  Compound spikes.
  2- FLOWER
  Sessile, bracteate, incomplete, and zygomorphic.
  3- PERIANTH
  It is combined structure instead of calyx and
  corolla. Number 2 or 3 membranous scales
  called " Lodicules"
  4- ANDROECIUM
  Usually 3 stamens, filaments long,
  free anther versatile.
  5- GYNOECIUM
  Tricarpellary, syncarpous though
  only one is functional, unilocular,
  single ovule, style short 2-3, stigma feather like.
  6- FRUIT
  Grain or coryposis.
  7- SEED
  Endospermic, monocotyledonous.
  FLORAL FORMULA
  + or O , O or O or O , P2 (lodicules) ,
  A3 or 0 , G1 or 0
- **ECONOMIC IMPORTANCE**
  1- FODDER AND FOOD STUFF
  Triticum indicum
  Avena sativa
  Zea mays
  Oryza sativa
  Hordeum vulgare
  Pennisetum typhoideum
  2- SUGAR MAKING
  Saccharum officinarum (sugar cane)
  3-PAPER MANUFACTURING
  Certain species of Grasses
  4- VEGETABLES & SOUP DISH
  Sugar cane
  Bamboo-shoots

KINGDOM ANIMALIA

(Tissue)

- **Parazoa**
  - **Porifera**
    - **General Characters**
      - No tissue organization.
      - Outer layer pinacoderm. (Pinacocyte)
      - Inner layer choanoderm (choanacytes: food ingested)
      - Between is mesenchyme.
      - Few mm to more than 1 meter.
      - Spongocoel.
      - Water enter the body through ostia.
      - Water leaves the body through = osculum.
      - No respiratory /No circulodory system.
      - Sessile
      - Adult sponge sessile / larvae move
      - No definite nervous system.
      - Spicules = Skeleton.
      - Asexual = Budding. } Internal (gemmules) / External
      - Sexual > Hermaphrodite (protandrous)
      - **Examples**
        Sycon, Leucoselania, Euplectella, Spogilla
- **Eumetazoa**

Symmetry

- **Radiata (Diploblastic)**
  - **Coelentrata (Cnidaria)**
    - **General characters**
      - Cnidocytes.
      - Gastrovascular cavity/enteron.
      - Polyps -> gastrozoids
      - Medusae-> free swimming (sexual)
      - Nervous system--> Network of neurons
      - No CNS
      - Sessile
      - Alternation of generation
      - Polymorphism
      - **Examples**
        Hydra
        Obelia
        Aurelia (jelly fish)
        Actinia (sea anemone)
        Medrepora (corals)
        Brachiocoeranthus.
- **Bilateral (Triptoblastic) Coelom**
  - **Acoelomate**
    - **Platyhelminthes**
      - **General characters**
        - Parasitic mode of life.
        - Few mm(10mm) --> several meters
        - Sac like digestive system.
        - Flame cells.
        - Well developed Nervous system.
        - Respiratory /circulatory system absent.
        - Reproduction } sexual (Hermaphrodites) / Asexual
        - **Examples**
          Dugesia (Planania)
          Fasciola hepatica (liver flake)
          Taenia solium (Tape worm)
          Infestan / Disinfestans
  - **Pseudocoelomate**
    - **Aschelminthes** (Nematoda)
      - **General Characters**
        - Pointed ends
        - Microscopic > 1meter
        - Tube like digestive system
        - Parasitic mode of life
        - Excretory system present
        - Nerve ring
        - Sensory papillae
        - Circulatory / Respiratory system absent
        - Sexual Reproduction.
        - **Examples**
          Ascaris lumbricoides
          Enterobius vermicularis
          Ancylostoma duodenale
  - **Coelomate**
    - **Proterostomes (Mouth from Blastopore)**
      - **Annelida**
        - **General characters**
          - Metamerically segmented
          - Prostomium = Digestion
          - Excretion = Nephridia
          - CNS = well developed
          - Close circulatory system
          - Respiratory system absent
          - Muscle produced
          - Organ of locomotion (setae)
          - Sexual
        - Classes
          - **Polychaeta**
            - Head with eyes
            - (Palps and eyes)
            - Sex = separate
            - Locomotion Parapodia
            - **Examples**
              Nereis
              Chaetopterus
          - **Oligochaeta**
            - Locomotion Setae
            - Head not prominent
            - Hermaphrodite
            - **Example**
              Lumbricus terrestris
              Pheretima posthuma
              Earthworm
          - **Hirudinea**
            - Body=fixed number of Segments
            - Annuls
            - No organ of Locomotion
            - Hermaphrodite
            - No distinct head
            - Anticoagulent Secretion
            - **Example**
              Hirudo medicinalis (Leech)
      - **Arthropoda**
        - **General characters**
          - More species than others
          - Segmented body
          - Appendages
          - cuticle
          - Haemocoel
          - Tube like digestive system
          - Excretory system=malpigian tube
          - Highly developed Nervous system
          - Trachea
          - Colorless Blood
          - Exoskeleton
          - Separate sexes
          - Metamorphosis
        - Classes
          - **Crustacea**
            - Two pair of antenna at head
            - One pair of Mandible
            - 2 pair of Maxilla
            - Separate sexes
            - **Example**
              Daphnia
              Cyclops
              Crabs
              Lobsters
              Prawn
              Wood louse
          - **Insect**
            - 1pair of antena
            - Compond eye
            - Separate sexes
            - **Example**
              Dragonfly
              Mosquito
              Butterfly
              Moth
              Wasp
              Bettles
          - **Archnida**
            - 2 pair of pedipalps
            - 4 pair of legs
            - No antenna
            - No true jaws
            - Book lungs
            - Separate sexes
            - **Example**
              Scorpion
              Spiders
              Mites
              Ticks
          - **Myriapoda**
            - 1 pair of legs /segment
            - 1 pair } antena / eyes
            - **Examples**
              Centipeds (Carnivora)
              Millipeds (Herbivores)
      - **Mollusca**
        - **General Characters**
          - Second largest group of Invetebrate
          - Mantle
          - Radula
          - Digestive (Tube like)
            Respiratory (Haemocoele) -> gills.
            Circulatory (open)
            Excretory (nephridia)
            Nervous-> 3 pair of ganglia } Head / Food / Body
            Reproduction
          - Muscular feet
          - Separate sexes
        - Classes = 5
          - **Gastropodes**
            - Body covered one piece shell
            - Asymmetrical
            - **Example**
              Helix aspersa (garden snail)
              Limax (the slug)
          - **Bivalvia (pelecypoda)**
            - Bilateral symmetry
            - 2pieces shell = body covered.
            - Plate like gills.
            - **Examples**
              Mytilus (Marine Mussel)
              Anodonta (freshwater mussel)
              Astrea (oyster)
          - **Cephalopoda**
            - Bilateral symmetry
            - Shell reduced/Internal.
            - **Example:**
              Loligo (Squid)
              Sepia (cuttle fish)
              Octopus
    - **Deuterostomes (Anus from Blastopore)**
      - **Echinodermata**
        - **General Characters**
          - Sea bottom (Marine)
          - Mouth lower surface
          - Anus upper surface
          - Larval stage = Exhibit lateral symmetry
          - sieve like plate
          - =Madriporite
          - No brain/ Nerve ring present
          - Separate sexes
          - Larval resembles chordates
          - **Examples**
            Asterian (star fish)
            Sea urchin, Sea cucumber
            Cake Urchin, Brittle star, Sea lily
      - **Hemichordata**
        - **General Characters**
          - Combination of Both Invertebrate + vertebrate
          - Pre-chordate
          - Body = Pitboscis + Collar + trunk
          - Circulatory system (Median dorsal + Median Ventral Vessel)
            Respiratory system = Gill slit
          - Sub-epidermal plexus
          - Nervous system
          - **Examples**
          - Balanoglossus
            Saccoglossus
      - **Chordata**
        - Characters
          - Notochord
          - CNS/dorsal
          - Paired gills in embryon

- **Acrania (Protochordata)** No cranium
  - **Urochordata**
    - Notochord + Nerve chord
    - Only in free swimming larvae
    - Adult are sessile and enclosed in covering =tunic
    - Tunicates (Molgula)
    - **Larvacea** — Oikopleura
    - **Ascidiacea** — Ascidia
    - **Thallacea** — Salpa
  - **Cephlochordata**
    - Notochord + Nerve chord Throughout the life (Amphioxus)
    - **Leptocardii** — Branchiostoma (Amphioxus)
- **Craniata** Cranium is present
  - **Vertebrata**
    - **Super class Pisces** (Aquatic)
      - **Cyclostomata** Nofoetal membrane
        - Most primitive living
        - vertebrates
        - Without Jaws
        - Eel like body
        - Scales absent
        - No paired appendages
        - Heart with one auricle.
        - Sexes separate (Lamprey)
        - sexes same (Hermaphrodite, Hag fish)
        - External fertilization
        - Example
          Lamprey
          Hag fish
      - **Chondrichthyes** Nofoetal membrane
        - Cartilaginous Skeleton
        - Placoid scales on body
        - J-shaped stomach
        - 5-7 pairs of gills.
        - No swim bladder
        - separate sexes.
        - oviparous, viviparous
        - **Examples**
          Shark, Skates
          Rays
          Whale
          Sting rays
          electric rays
      - **Osteichthyes** Nofoetal membrane
        - Bony Skeleton
        - No placoid scales
        - Jaws with or without teeth
        - Swim bladder
        - 2 chamber Heart
        - Brain 10 pairs of cranial nerves.
          Separate sexes
        - **Examples.**
        - Bony Fishes
    - **Superclass Tetrapoda** (Teretrivial)
      - **Amphibia** Nofoetal membrane
        - Double life
        - 2 pair of Joint legs
        - Bony Skeleton mostly
        - Respiration > Lavrae > gills
          Adult > Lungs
        - 3 chamber Heart
        - Separate sexes
        - Cold blooded (Poikilothermic)
        - **Examples.** Frog, Toad, Salamender
      - **Reptiles**
        - Ventricle of Heart incompletely Partitioned
        - Poikilothermic
        - **Examples**
          Lizard
          Snake
          Sphenodon
      - **Aves**
        - Archaeopteryx
        - Warm blooded
        - Forelimbs wings
        - Syrinx
        - **Example**
          Ostrich, Mallard
          Kiwi, Robin
          Kingfisher, Kestral
      - **Mammalia** Cotylosaurs Varanope
        - 4 chamber Heart
        - Homeotherms
        - RBCs → Non Nucleated
        - 3 Bones in Ear
        - Body Covering of Hairs
        - **Prototheria**
          - egg laying
          - **Example**
            Duck bill Platypus
            Echidna (spiny ant-eater)
        - **Metatheria**
          - Pouched
          - **Example**
            Opossum
            Kangroo
            Tasmanian wolf
        - **Eutheria**
          - Placenta
          - Example
            Man, Whale
            Elephant
            Horse
            Rat

MCQs of VARIETY OF LIFE

1. **Rabies is due to:**
   A) Fungi B) Bacteria C) Protozoan D) Virus
2. **The hereditary material of Polio virus is:**
   A) RNA B) DNA C) Single stranded DNA D) None of these
3. **The smallest virus is of:**
   A) Paramyxovirus B) Herpes simplex C) Cow pox D) Poliomyelitis
4. **Serum hepatitis is also known as:**
   A) Hepatitis A B) Hepatitis B C) Hepatitis C D) All of these
5. **Pig could be the source of infection of hepatitis:**
   A) E B) B C) A D) D
6. **Chronic liver disease is most frequently caused by:**
   A) HAV B) HBV C) HCV D) HIV
7. **Which is referred to as the inflammation of liver:**
   A) AIDS B) Hepatitis C) Mumps D) Nephrosis
8. **Capsid of polio virus is:**
   A) Spherical B) Helical C) Cylindrical D) None of these
9. **Hepatitis A virus is:**
   A) DNA enveloped C) RNA enveloped
   B) DNA non enveloped D) RNA non enveloped
10. **Halbur & coworkers revealed fact about hepatitis E in:**
    A) 2002 B) 2004 C) 2005 D) 2001
11. **About 60% of adults are immune to it:**
    A) Measles B) Mumps C) Herpes D) Small pox
12. **250nm is the size of which of the followings?**
    A) Pox virus B) Adenovirus C) Parvovirus D) Polio virus
13. **Lysozyme damages the bacterial call wall by:**
    A) Oxidation B) Hydrolysis C) Reduction D) None of these
14. **Viruses are the particles of which?**
    A) Nucleic acid only C) Nucleic acid & Protein
    B) Proteins only D) None of these
15. **The major cell infected by HIV is:**
    A) B-lymphocyte C) Helper T-Lymphocyte
    B) T-lymphocyte D) Suppressor T lymphocyte
16. **Of the following which one is Retrovirus?**
    A) HIV B) Influenza C) Mumps D) All of These
17. **The virus which has cancer causing genes:**
    A) Oncovirus B) Phage C) Provirus D) Retrovirus
18. **Which of the following is symptom of AIDS:**
    A) Swollen lymph nodes B) Weight loss C) Pneumonia D) All of these
19. **Oncoviruses are:**
    A) Spherical B) Cubical C) Rod shaped D) Icosahedral
20. **_____ are underground fruiting bodies that people find with the help of trained dogs or pigs:**
    A) Mushrooms B) Truffles C) Morel D) Toad-stools
21. **The poisonous material in the ergot can cause:**

A) Nervous system & convulsion C) Gangrene
B) Psychotics delusions D) All of these

22. **Which is the Poisonous mushroom?**
A) Amanita B) Morchella C) Jack-O'latern D) Both A & C

23. **Which option is correct about aspergillosis?**
1. **It is caused by eating bread made from purple ergot-contaminated rye flour.**
2. **It is caused by Aspergillus fumigatus**
3. **It is found only in persons with defective immune system such as AIDS**
A) 1 and 2 B) 1 and 3 C) 2 and 3 D) 1, 2 and 3

24. **A serious infection of lungs caused by inhaling spores of a fungus which is common in soil contaminated with bird's faeces:**
A) Athelete's foot B) Aspergillosis C) Histoplasmosis D) Candidiasis

25. **Ringworm are superficial fungal infections caused by certain ____ fungi:**
A) Conjugating B) Sac C) Club D) Imperfect

26. **Which of the following is not plant disease caused by fungi?**
A) Late blight of potatoes B) Powdery mildews
C) Ergot of rye D) Red rot of sugar cane

27. **_____ is/are obtained from some Aspergillus species:**
A) Soya sauce B) Soya paste C) Citric acid D) All of these

28. **___ is used to lower blood cholesterol:**
A) Penicillin B) Lovastatin C) Ergotine D) Griseofulvin

29. **Zygospores germinate during:**
A) Mitosis B) Meiosis C) Both A,B D) Nuclear Mitosis

30. **Ergotism is caused by eating bread made from:**
A)Purple ergot – contaminated rye flavor C)Brown ergot – contaminated rye flavour
B)Orange ergot – contaminated rye flavour D)Black ergot – contaminated rye flavour

31. **Oomycotes are closely related to fungi. Their cell walls contain**
A) Chitin C) Cellulose
B) Peptidoglycan D) $CaCO_3$

32. **The hyphae in which cytoplasm moves efficiently, distributing the materials throughout is known as:**
A) Coenocytic hyphae C) Dikaryotic hyphae
B) Septate Hyphae D) None of these

33. **Parasitic fungi absorb nutrients directly from the living host cytoplasm with the help of special hyphal tips called:**
A) Tentacles C) Haustoria
B) Stings D) Rhizome

34. **Which one of the following is omnivorous predatory fungus?**
A) Pleurotus ostreatus C) Aemillaria
B) Penicillium D) Parmelia

35. **Fungi can tolerate the pH range from:**
A) 2-4 C) 5-7
B) 2-9 D) 4-12

36. **The example of imperfect fungi is:**
A) Truffles C) Molds

B) Rhizopus
D) Aspergillus

37. **How much ascospore are produced inside each ascum:**
A) 2
B) 4
C) 6
D) 8

38. **Imperfect fungi show special kind of genetic recombination called:**
A) Budding
B) Parasexuality
C) Meiosis
D) Conjugation

39. **These are underground fruiting bodies of some ascomycetes and are common edible fungi.**
A) Truffles
B) Alternaria
C) Jack-O'lantern
D) Amanita

40. **A yeast that causes oral and vaginal thrush:**
A) Rust
B) Aflatoxins
C) Omphalotus olearius
D) Candida albicans

41. **It is pink yeast that grows on shower curtains and other moist surfaces.**
A) Agaricus
B) Penicillium
C) Rhodotorula
D) Toadstools

42. **Which of the following is used to control fungal growth:**
A) Griseofluvin
B) Ergotine
C) Lovastatin
D) Neurospora

43. **Zea Mays belongs to which family:**
A) Poaceae
B) Solanaceae
C) Fabaceae
D) Mimosaceae

44. **The living genera in Psilopsida are:**
A) Psilotum and Cooksonia
B) Tmesipeteris and Lycopods
C) Cooksonia and Lycopods
D) Psilotum and Tmesipeteris

45. **Lycopods were the first plants that formed the true:**
A) Leaves and stem
B) Seed and fruits
C) stem and fruits
D) leaves and roots

46. **The size of prothallus in Adiantum is about _____ at its longest diameter.**
A) 8mm
B) 6mm
C) 6cm
D) 8cm

47. **Ciliates are unicellular organisms with a flexible outer covering, that give them a definite but changeable shape, called:**
A) Cell Wall
B) Pellicle
C) Murein
D) Capsule

48. **Which one is sessile Ciliate?**
A) Paramecium
B) Trypanosoma
C) Plasmodium
D) Stentor

49. **These blooms frequently color the water orange, red or brown and are known as red tides:**
A) Diatoms
B) Red algae
C) Brown algae
D) Dinoflagellates

50. **Which one of the following is a brown algae:**
A) Chlorella
B) Diatoms
C) Laminaria
D) Polysiphonia

51. **All are the examples of green algae except:**

A) Spirogyra
B) Ceratium
C) Ulva
D) Chlamydomonas

52. **The feeding stage of a slime mode is:**
A) Plasmodium
B) Kelps
C) Rhizome
D) Ulva

53. **They are characterized by an abdominal pouch the, marsupium, where the rear their young one:**
A) Metatheria
B) Eutheria
C) Prototheria
D) Homotheria

54. **The smallest known virus is:**
A) Poxvirus
B) Influenza virus
C) Polio virus
D) Paramyxo virus

55. **Icosahedral means:**
A) 5 Faces
B) Cubical
C) more than 20 faces
D) 20 faces

56. **Yellow fever is caused by:**
A) Fungi
B) Bacteria
C) Virus
D) Protozoan

57. **Prions Causes:**
A) Foot and mouth Disease
B) Rabies
C) Common Cold
D) Mad Cow Disease

58. **Polymorphism is characteristic feature of:**
A) Porifera
B) Cnidaria
C) Annelida
D) Platyhelminthes

59. **Fasciola is a name given to:**
A) Tapeworm
B) Hookworm
C) Planaria
D) Fluke

60. **Ancylostoma duodenale is commonly known as:**
A) Pin worm
B) Hook worm
C) Tape worm
D) Earth worm

61. **In arthropods, the body cavity is in the formof:**
A) Acoelom
B) Haemocoel
C) Pseudocoelom
D) Enteron

62. **Disinfestation of flat worms is carried out by:**
A) Anema
B) Anemia
C) Radiotherapy
D) Lithotripsy

63. **The intermediate host for Taenia (tape worm) is:**
A) Fish
B) Pig
C) Cow
D) Man

64. **Select the best option for Limax:**
A) Snail
B) Squid
C) Slug
D) Cuttlefish

65. **Coelom formation by out pouching of the archenteron is:**
A) Hemocoelous
B) Schizocoelous
C) Enterocoelous
D) Pseudocoelous

66. **Triploblastic Animal cannot be:**

A) Symmetrical
B) Asymmetrical
C) Coelomate
D) Acoelomate

67. **The Arthropod larva resemble to the adult is called:**
A) Instar
B) Nymph
C)Pupa
D) Both A&B

68. **All fungi differ from algae in**
A) Lacking chlorophyll and in having cell wall which is chitinized
B) Being coenocytic
C) Lacking unicellular forms
D) Have Centrioles

69. **Viruses cannot multiply of their own because they**
A) Do not have sex organs
B) Lack genetic material
C) Lack cellular machinery to use its genetic material
D) None of the these

70. **Viral genome, incorporated and integrated with bacterial genome is referred to as**
A) Prophages
B) DNA
C) RNA
D) Both (A) and (C)

71. **_____ is a parasite of large intestine of human beings and causes the disease_____.**
A) Escherichia coli, amoebic dysentery
B) Entamoeba histolytica, amoebic dysentery
C) Plasmodium vivax, malaria
D) Trypanosoma gambiense, sleeping sickness

72. **Red tides in warm coastal water develop due to the abundance of**
A) Dinoflagellates
B) Euglenoids
C) Diatoms and desmids
D) Spirogyra

73. **Which of the following statements about Euglena is correct?**
A) Euglena is a flagellate organism.
B) Euglena when placed in continuous darkness, loses its photosynthetic activity and dies.
C) The pigments of Euglena are quite different from those of green plants.
D) Euglena is a marine protist.

74. **Which is common disease of sugar cane?**
A)Brown rot
B)Wilt
C) Red rot
D)Powdery mildews

75. **Which of these diseases could NOT be treated with antibiotics?**
A) Tuberculosis
B) Influenza
C) Pneumonia
D) Anthrax

Answers:

1.	D	2.	A	3.	D	4.	B	5.	A	6.	C	7.	B	8.	A	9.	D	10.	D
11.	B	12.	A	13.	B	14.	C	15.	C	16.	A	17.	A	18.	D	19.	A	20.	B
21.	D	22.	D	23.	C	24.	C	25.	D	26.	A	27.	D	28.	B	29.	B	30.	A
31.	C	32.	A	33.	C	34.	A	35.	B	36.	D	37.	D	38.	B	39.	A	40.	D
41.	C	42.	A	43.	A	44.	D	45.	D	46.	A	47.	B	48.	D	49.	D	50.	C
51.	B	52.	A	53.	A	54.	C	55.	D	56.	C	57.	D	58.	B	59.	D	60.	B
61.	B	62.	A	63.	B	64.	C	65.	C	66.	B	67.	D	68.	A	69.	C	70.	A
71.	B	72.	A	73.	A	74.	C	75.	B										

ASSESS YOURSELF

1. **Which of the following disease is caused by enveloped RNA Virus and spread in epidemic**
   A) Influenza B) Herpes simplex C) Polio D) Smallpox
2. **The structure which contains the gene for drug resistance in bacteria?**
   A) Nucleoids B) Mesosomes C) Chromatin bodies D) Plasmids
3. **Which of the following fungi causes vaginal thrash?**
   A) Microbistatic B) Microbial C) Biostatic D) Yeast
4. **In HIV Viruses,Reverse transcriptase converts single stranded RNA into double stranded viral DNA. This process is called:**
   A) Transcription B) Duplication C) Replication D) Reverse transcription
5. **Mesosomes are infoldings of cell membrane and are involved in:**
   A) DNA Replication B) RNA Synthesis C) Protein synthesis D) Metabolism
6. **Which of the following component is found in the cell wall of fungi:**
   A) Cellulose B) Chitin C) Proteins D) Glycerol
7. **Most wide spread problem of the antibiotic misuse is:**
   A) Rapid care C) Disturbance of metabolism
   B) Increased resistance in pathogens D) Immunity
8. **Reverse transcription is used to make DNA copies of:**
   A) Host RNA B) Viral RNA C) Host DNA D) Viral DNA
9. **Antibiotics are produced by fungi and certain bacteria of group:**
   A) Actinomycetes B) Oomycetes C) Ascomycetes D) Basidiomycetes
10. **Which statement about bacteria is true:**
    A) Gram positive bacteria have more lipids in their cell wall
    B) Gram negative bacteria have more lipids in their cell wall
    C) Lipids are absent in cell wall of both gram positive and negative bacteria
    D) Both have equal amount of lipids
11. **Fungi which cause thrush in humans:**
    A) Sarcomeres B) Candidiasis C) Lovastatin D) Aspergillus
12. **Which one of the following cells are mainly infected by HIV?**
    A) T-killer lymphocytes C) B-plasma cells
    B) T-helper lymphocytes D) B-memory cells
13. **Which one of the following antibiotic causes permanent discoloration of teeth in young children if it is misused?**
    A) Penicillin B) Streptomycin C) Sulfonamide D) Tetracycline
14. **What are the sequence of steps in which a bacteriophage attacks bacteria and injects its DNA?**
    A) Landing-Tail contraction-Penetration-DNA injection
    B) Penetration-Landing-Tail contraction-DNA Injection
    C) Tail contraction-Landing-DNA injection-Penetration
    D) Landing-Penetration-Tail contraction-DNA injection
15. **Athlete's Foot is a disease caused by:**
    A) Bacteria B) Virus C) Fungus D) Arthropod
16. **Number of capsomeres in adenovirus, which causes common cold, are:**
    A) 162 C) 252
    B) 262 D) 525

7. **Host cells of HIV possess which kind of receptor site that allows the adsorption and penetration:**
A) C4
B) Cd4
C) CS4
D) CoA

8. **Retrovirus has a specific enzyme called:**
A) Reverse transcriptase
B) Isomerase
C) Polymerase
D) Topoisomerase

9. **Tobacco mosaic virus is:**
A) Rod shape
B) Round
C) Icosahedral
D) Hexagonal

20. **The major cell infected by HIV is the:**
A)Killer T cells
B) Helper T-cells
C) Monocytes
D) RBCs

21. **HIV is:**
A) Enveloped DNA virus
B) Non-Enveloped DNA virus
C) Enveloped RNA virus
D) Non-Enveloped RNA virus

22. **It is commonly called Venus flower basket.**
A) Sycon
B) Euplectella
C) Spongilla
D) Leucosolenia

23. **This is known as Portuguese man of war:**
A) Sycon
B) Obelia
C) Jelly fish
D) Physalia

24. **Which of the following is commonly called Corals.**
A) Aurelia
B) Obelia
C) Actinia
D) Madrepora

25. **The body cavity of nematodes is knows as:**
A)Acoelom
B) Pseudocoelom
C) Metacoelom
D) True coelom

26. **Excretion in segmented worms take place by specialized structure called:**
A) Flame cells
B) Nephridia
C) Protonephridia
D) Malpigian tubules

27. **How many eyes do most spiders have that allow them a panoramic view of the predator and prey?**
A) 16
B) 8
C) 4
D) 6

28. **Which one of the following is the Second largest phylum?**
A)Arthropoda
B) Echinodermata
C) Nematoda
D) Mollusca

29. **In the mouth of many mollusks there is a rasping tongue-like structure that provides with many horny teeth.**
A) Radula
B) Protostomium
C) Papillae
D) Scaly outgrowth

0. **The organ of voice in bird in known as:**
A) Glottis
B) Epiglottis
C) Syrinx
D) Larynx

. **This is an integumented indehiscent megasporangium:**

A) Embryo
B) Seed
C) Ovule
D) Fruit

32. **They are heterosporous plants which produce seeds but no fruits.**
A) Angiosperms
B) Gymnosperms
C) Bryophytes
D) All

33. **Mimosaceae is also called:**
A) Grass Family
B) Rose family
C) Cassia family
D) Acasia family

34. **Apple, Pear Almond, Apricot, and Strawberry are important fruits of:**
A) Rosacea family
B) Grass Family
C) Cassia Family
D) Ascasia Family

35. **It causes amoebic dysentery in humans.**
A) Chlamydomonas
B) Entamoebahistolytica
C) Pelomyxapalustris
D) Giant amoeba

36. **They are complex, specialized flagellates with many flagella which live as symbionts in the gut of termites.**
A) Giant amoeba
B) Pin worm
C) Trichonymphas
D) Trypanosoma

37. **The causing agent of African sleeping sickness is:**
A) Trypanosoma
B) Ciliates
C) Choanoflagellates
D) Trichonymphas

38. **Choanoflagellates are of special interest because of their striking resemblance to collar cells in:**
A) Flagella
B) Fungi
C) Sponges
D) Ciliates

39. **Protozoans are**
(a) Heterotrophs
(b) Parasites or predators
(c) Protist
(d) Believed to be primitive relative of animals
A) A and B only
B) B and C only
C) D and A only
D) All of these

40. **False feet is the characteristic of which protozoan?**
A) Sporozoan
B) Ciliated protozoan
C) Flagellated protozoan
D) Amoeboid protozoans

41. **The following features belongs to**
A. Body consist of long, slender thread – like structures called hyphae.
B. Cell wall consist of chitin.
C. Cosmopolitan
A) Ciliated protozoans
B) Slime molds
C) Fungi
D) Euglenoids

42. **Gymnosperms are the plants which**
A) Bear flowers
B) Bear fruits but no vascular tissue
C) Produce seeds in cones
D) Do not produce seeds in cones

43. **The endosperm of gymnosperms is haploid because**
A) It is a gametophytic tissue
C) It is not the product of triple fusion

B) Double fertilization does not take place D) All the above reasons

44. Which of the following pigments are found in brown algae?

A) Chl a, Chl c
B) Chl a, Chl d
C) Chl a, Chl c and fucoxanthin
D) Chl a, phycoerythrin

45. Coelentrates are

A) Multi – layered
B) Diploblastic
C) Triploblastic
D) Monoblastic

46. In bryophytes

A) Sporophytes are dependent upon gametophytes
B) Sporophyte and gametophyte generations are independent
C) Sporophyte in itself completes the life cycle
D) Gametophytes are dependent upon sporophyte.

47. The segment of Taenia solium is called as

A) Ring
B) Metameric
C) Segment
D) Proglottids

48. Fasciola hepatica lives in

A) Liver of sheep
B) Blood of sheep
C) Intestine of sheep
D) Spleen of sheep

49. Body cavity of Hydra is called

A) Enterocoel
B) Coelenteron
C) Gastrovascular cavity
D) Both (B) and (C)

50. Bilateral symmetry, blastopore mouth and true coelom occur in

A) Echinodermata
B) Chordata
C) Annelida
D) Platyhelminthes

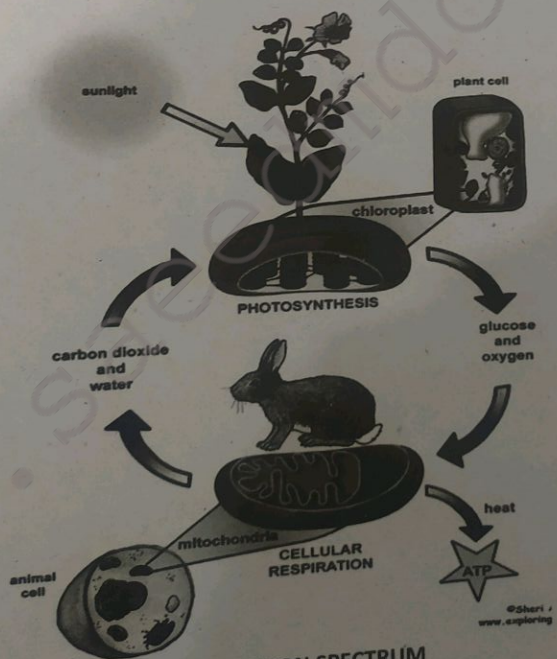
CHAPTER 04

BIOENERGETICS

COURSE CONTENT

- Photosynthetic Pigments (Chlorophylls and Carotenoids)
- Absorption and Action Spectra
- Light – Dependent Reactions (cyclic and non – cyclic phosphorylation) and light – Independent Reactions (Calvin cycle).
- Cellular Respiration: Glycolysis, Link reaction / Pyruvic Oxidation, Kreb's Cycle (with reference to production of NADH, FADH and ATP) and ETC
- Anaerobic Respiration and its Types (Alcoholic and Lactic Acid Fermentation).

Photosynthesis and Cellular Respiration



A) PHOTOSYNTHETIC PIGMENTS & ABSORPTION SPECTRUM

- Photosynthetic pigments are the substances that absorb **visible light** (380-750 nm wavelength).

- **Spectrophotometer** is an instrument, which is used to measure the relative abilities of different pigments to absorb different wavelength of light.
- **Absorption Spectrum** is a graph showing absorption of light of different wavelength by a pigment.

PHOTOSYNTHETIC PIGMENTS
- **Chlorophyll ....** Main photosynthetic pigment
- **Carotene ....** Orange to red pigments
- **Xanthophylls ....** Yellow to orange.

CHLOROPHYLLS

- They are **main photosynthetic pigments of plants**.
- They are **insoluble in water** but are **soluble in organic solvents** like carbon tetrachloride, alcohol etc.
- **Chlorophyll a, b, c, and d** are found in eukaryotic photosynthetic plants and algae.
- **Bacterochlorophylls** are found in photosynthetic bacteria.
- They mainly **absorb violet – blue and orange – red wavelength**. Green, yellow and indigo wavelength are last absorbed by chlorophylls and transmitted or reflected.

Structure

- A chlorophyll molecule has two parts i.e. **hydrophilic head** and a **hydrophobic hydrocarbon tail**.
- **Hydrophilic head** is flat, square, light absorbing complex porphyrin ring or tetra pyrrole ring structure containing magnesium as central metal ion, which is coordinated with nitrogen.
- **Hydrophobic hydrocarbon tail** is long, anchoring phytol ($C_{20}H_{39}$).

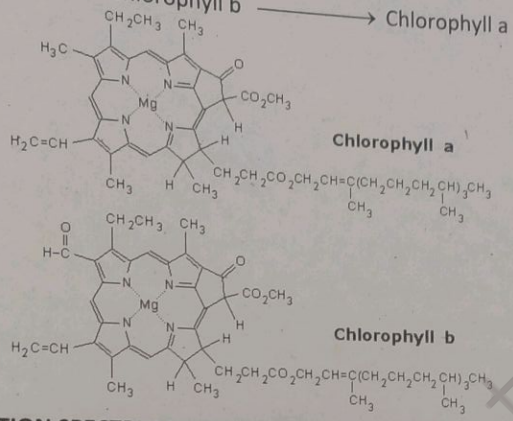
DIFFERENCE	CHLOROPHYLL a	CHLOROPHYLL b
Definition	Primary photosynthetic pigment	Accessory photosynthetic pigment
Molecular formula	$C_{55}H_{72}O_5N_4Mg$	$C_{55}H_{70}O_6N_4Mg$
Functional group	$-CH_3$ (methyl group)	-CHO (carbonyl group)
Occurrence	All photosynthetic organisms except photosynthetic bacteria	In association with chlorophyll a in all green plants and green algae
Forms	Differ slightly in their red absorbing peaks e.g. 670, 680, 690, 700 nm	No such different forms
Color	Blue – Green	Yellow – Green

ACCESSORY PIGMENTS

- They absorb strongly the **blue – violet range**.
- **Carotenoids and chlorophyll b** are called accessory pigments, since they absorb light and transfer the energy to chlorophyll a, which then initiate the light reaction.
- Some of these may **protect chlorophyll** by absorbing intense light.

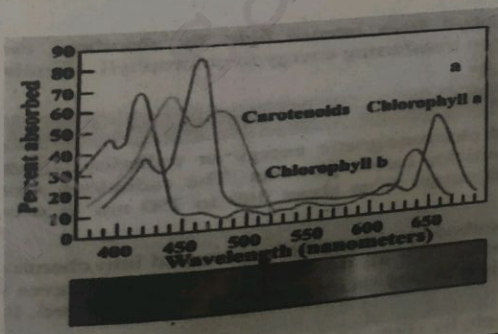
- Similar carotenoids may **protect human eye**.
- Transfer of energy is as under.

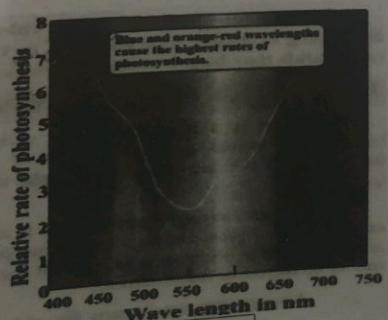
Carotenoids ⟶ Chlorophyll b ⟶ Chlorophyll a



ABSORPTION AND ACTION SPECTRUM

- Light is form of energy called electromagnetic energy or radiations. It behaves as waves as well as sort of particles called photons.
- The radiations most important for life are the visible light that ranges from about **380 to 750 nm** wavelength.
- Only about 1% of the light falling on the leaf surface is absorbed, the rest is reflected or transmitted.
- **Graph showing relative absorption of different wavelengths of light by different photosynthetic pigments is called absorption spectrum.**
- Absorption spectrum of chlorophylls indicates that absorption is maximum in blue and red parts of the spectrum, two absorption peaks being at around **430 nm and 670 nm** respectively.
- Absorption peaks of carotenoids are different from those of chlorophylls.
- **Graph showing relative effectiveness of different wavelengths of light in driving photosynthesis is called action spectrum of photosynthesis.**





Peaks	Narrow	Broader
Valley	Broader and deep	Narrow and not deep

- **The first action spectrum was obtained by German biologist T. W .Engelmann in 1883. He worked on Spirogyra.**
- Action spectrum can be obtained by illuminating plant with light of different wavelengths and then estimating relative CO_2 consumption or oxygen release during photosynthesis.
- Action spectrum of photosynthesis corresponds to absorption spectrum of chlorophyll. The same two peaks and the valley are obtained for absorption of light as well as for CO_2 consumption.
- When equal intensities of light are given, there is more photosynthesis in red than in blue part of spectrum.

B) LIGHT DEPENDENT STAGE OR REACTION

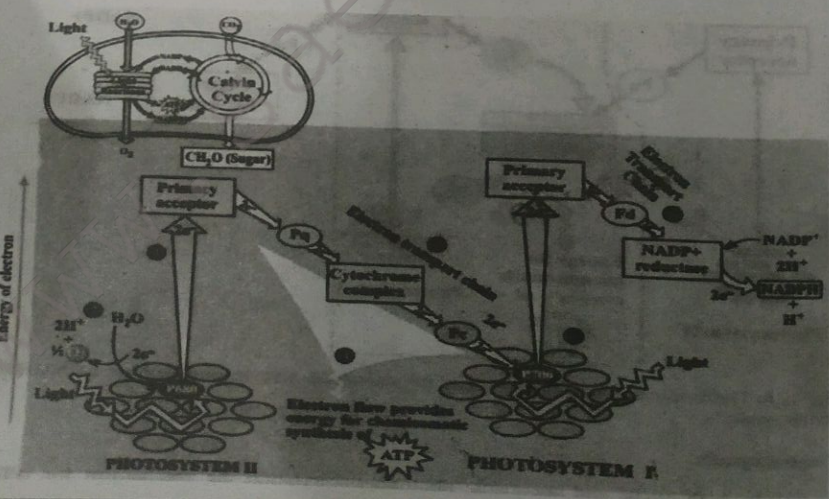
- Such types of reactions, which require light and constitute that phase of photosynthetic reaction during which light energy is absorbed by chlorophyll and other photosynthetic pigment molecules and converted into chemical energy are called light reactions.
- Photosynthetic pigments are organized into clusters called **photosystems**.
- **Antenna complex** has many chlorophylls a, b and carotenoids, which channelize energy to reaction center.
- **Reaction center** is constituted by chlorophyll a along with primary electron acceptor to associated electron carriers of electron transport system.
- **Primary electron accepter** traps the high energy electron from the reaction center and then passes them on to the series of electron carriers.

TYPES OF PHOTOSYSTEM

- **PS I** has chlorophyll a molecule which absorbs maximum light of 700 nm also called as P_{700}.
- **PS II** has a form of chlorophyll a molecule which absorbs maximum light of 680 nm and also called as P_{680}.

NON-CYCLIC PHOTOPHOSPHORYLATION

- Non-cyclic photophospharylation is also called **Z-scheme**.
- Splitting of water by light is called **photolysis**. OR H_2O splitting step of photosynthesis that release O_2, is called photolysis.



- **The path of electrons through the two photosystems during non-cyclic photophosphorylation is known as Z-scheme from its shape.**

PASSAGE OF ELECTRONS

PS II → Primary Electron → Pq → Cytochrome Complex → Pc → PS I
Primary Electron Acceptor → Fd → NADP+

- **CYCLIC PHOSPHORYLATION**

Formation of ATP during cyclic electron flow is called cyclic phosphorylation. It is less common type of electron transport. The electrons pass through only photosystem I.
Cyclic phosphorylation will continue only until ATP supply meets the demand.

END PRODUCTS OF LIGHT REACTION

- NADPH/ $NADPH_2$
- ATP

CHEMIOSMOSIS

- Pumping of H^+ (during photosynthesis) across the membrane of thylakoids into the thylakoid interior and then the movement of H^+ down their gradient into the stroma, through ATP synthatase, to produce ATP is called chemiosmosis. OR It is the process that uses thylakoid membranes for redox reactions to produce ATP.
- In both cyclic and non-cyclic phosphorylation, the mechanism for ATP synthesis is chemiosmosis. Similarly in Mitochondria formation of ATP in ETS is by Chemiosmosis.

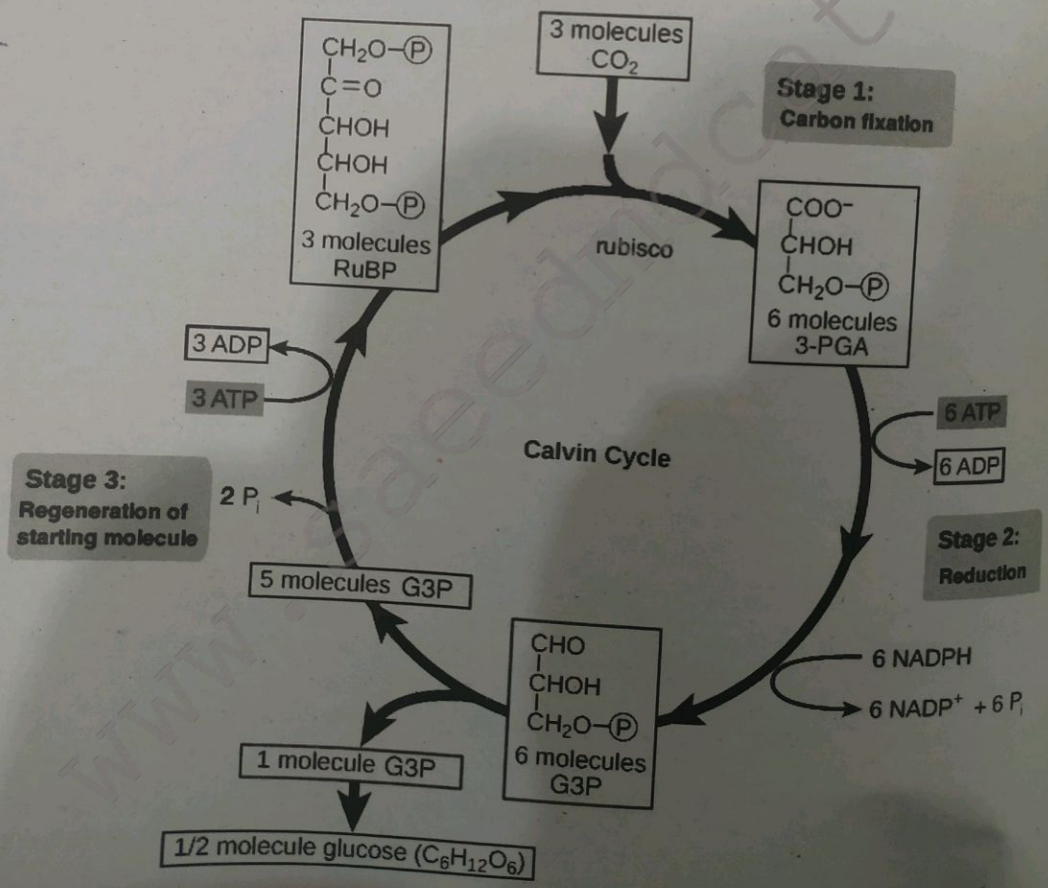
COMPARISON OF CYCLIC AND NON-CYCLIC PHOTOPHORYLATION

NON-CYCLIC	CYCLIC
Electrons are not reused	Electrons are reused
It involves both PS I and II	It involves only PS I
First electron donor is WATER	First electron donor is P_{700} **(PS-I)**
It is long pathway	It is short circuit
It is normal process	It occurs when ATP are less and NADPH more.
It generates both ATP and NADPH.	It generates only ATP.
Oxygen is released.	Oxygen is not released.
Last electron acceptor is **$NADP^+$**	Last electron acceptor is P_{700} **(PS-I)**

C) **LIGHT INDEPENDENT STAGE (DARK REACTIONS)**

- Those reactions which do not require light directly and can occur in the presence or absence of light provided that assimilatory power in the form of ATP and NADPH, produced during the light reaction is available are called dark reactions and constitute light independent phase of photosynthesis.
- **Takes place in stroma of chloroplast.**
- **The cyclic series of reactions, catalyzed by enzymes, by which the carbon is fixed and reduced, resulting in the synthesis of sugar during the dark reactions of photosynthesis is called Calvin Cycle.**
- The path of carbon in these reactions was discovered by Melvin Calvin and his colleagues at the University of California. Calvin was awarded Nobel Prize in **1961.**

- It is divided into three steps:
  - **Carbon fixation**
  - **Reduction**
  - **Regeneration of CO_2 acceptor.**
- CO_2 fixation is dependent on ribulose bisphosphate carboxylase **(Rubisco)**.
- Rubisco is most abundant protein in chloroplast and on earth.
- From the Calvin cycle, G3P is produced directly (not glucose).
- For every three molecules of CO_2 entering the Calvin cycle and combining with 3 molecules of five carbon RuBP, six molecules of G3P (containing 18 carbon in all) are produced. However only one molecule leaves the cycle.
- G3P is used by the plant for making glucose, sucrose, starch or other carbohydrates and other organic compounds.



$3CO_2 + 6NADPH + 9ATP \rightarrow (CH_2O)_3 + 6NADP + 9ADP + 9P_i + 3H_2O$

Difference between Light Dependent & Independent Reactions

	Light Dependent Reactions	Light Independent (Dark) Reactions
Definition	The reactions that require direct involvement of light energy and light – absorbing pigments.	These reactions require no light energy directly. But indirectly they use light
Area of Occurrence	Thylakoids/ Grana of chloroplasts	Stroma of chloroplasts
Source of Energy	Uses low – energy electron carriers and converts the particles into high – energy electron carriers	Uses the energy from the high – energy electron carriers created in the light – dependent reaction to create CHOs.
Reactants	H_2O, ADP, $NADP^+$ and Sunlight	ATP , NADPH, CO_2
Energy	Energy conversion	Energy conversion
Products	ATP, NADPH, $O_2\uparrow$	Carbohydrates (Sugars), ADP, $NADP^+$
Speed	Instantaneous speed	Slow speed

CELLULAR RESPIRATION

- Respiration is the universal process by which organism's breakdown complex compounds containing carbon in a way that allows the cells to harvest a maximum of usable energy.
- **External respiration** involves exchange of respiratory gases between the organism and its environment.
- **Cellular respiration** is the process by which energy is made available to cells in a step by step breakdown of C-chain molecules in the cell.
- Cellular respiration is an **oxidation process.**
- The most common fuel used by the cell to provide energy by cellular respiration is glucose.

AEROBIC & ANAEROBIC RESPIRATION

- The way glucose is metabolized depends on the availability of oxygen.
- First step of cellular respiration (Glycolysis that splits glucose molecule into two molecules of pyruvic acid) is common in aerobic anaerobic respiration.

$$C_6H_{12}O_6 \xrightarrow{2NAD \rightarrow 2NADH_2} 2C_3H_4O_3 + Energy$$

- **CELL PROCESSES PYRUVIC ACID IN THREE MAJOR WAY:**
  - ✓ **Alcoholic fermentation**
  - ✓ **Lactic acid fermentation**

✓ Aerobic respiration

FEATURE	AEROBIC RESPIRATION	ANAEROBIC RESPIRATION
Involvement of Oxygen	Occurs in presence of O_2	Occurs in absence of O_2
Reactants	Glucose & O_2	Glucose
Glucose Breakdown	Complete breakdown of glucose	Incomplete breakdown of glucose
End Products	CO_2, H_2O and energy	Lactic acid or Ethyl alcohol & CO_2
ATP Formed	Total: 40 ATP Net: 36 or 38 ATP	Total : 4 ATP Net: 2 ATP
Energy of Glucose Released	98%	2%
Location in Eukaryotic Cell	Mitochondria	Cytoplasm

ANAEROBIC RESPIRATION

✓ **Alcoholic Fermentation**

- It occurs in primitive cells and in some eukaryotic cells such as yeast.
- Pyruvic acid is broken into ethyl alcohol and CO_2

$$2NADH_2 \quad 2NAD$$

$$2(C_3H_4O_3) \rightarrow 2(C_2H_5OH) + 2CO_2$$

✓ **Lactic Acid Fermentation**

- It occurs in muscle cells of humans and other animals during extreme physical activities such as sprinting.

$$2NADH_2 \quad 2NAD$$

$$2(C_3H_4O_3) \rightarrow 2(C_3H_6O_3)$$

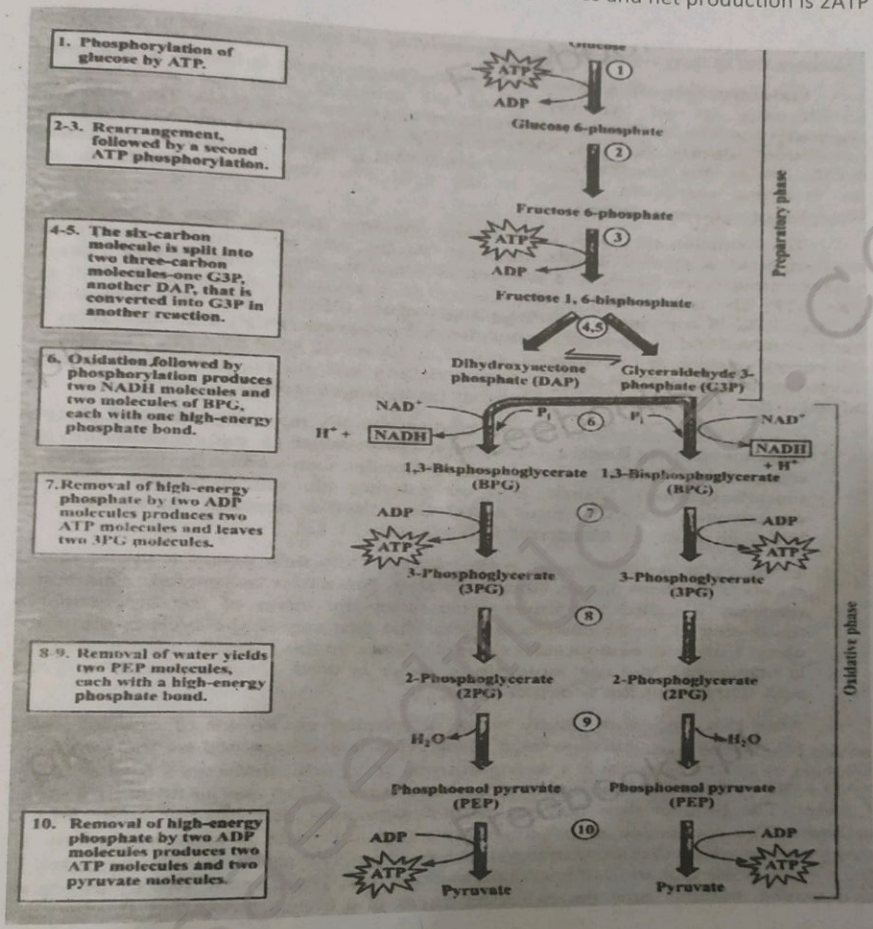
AEROBIC RESPIRATION

- Aerobic respiration may be subdivided into four stages:
  - (i) **Glycolysis**
  - (ii) **Pyruvic acid oxidation**
  - (iii) **Krebs cycle or citric acid cycle.**
  - (iv) **Respiratory chain.**

GLYCOLYSIS

- Its meaning is **splitting of sugar**.
- It is generally break down of one glucose molecule into two molecules of pyruvic acid.
- It occurs in **cytoplasm**.
- May take place in the absence (**Anaerobic**) or in the presence of O_2 (**Aerobic** conditions).
- Enzymes, ATP, and Coenzymes NAD (nicotinamide adenine dinucleotide) are essential for glycolysis.

- There are **two phases** of glycolysis i.e. **preparatory phase** (breakdown of glucose, utilization of ATP) &**oxidative phase** (formation of ATP).
- Total production of ATP during glycolysis is 4ATP molecules and net production is 2ATP molecules.

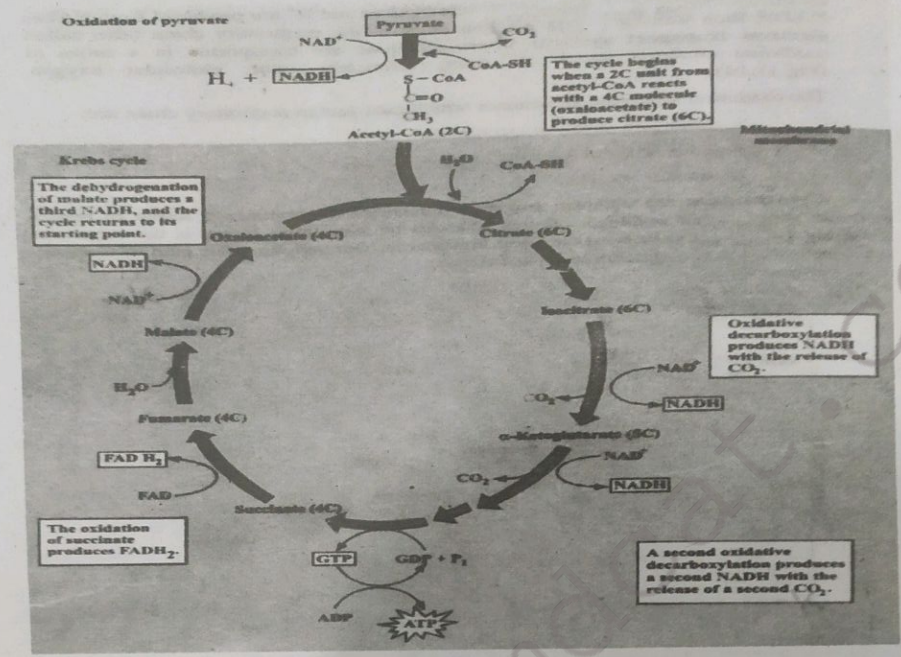


PYRUVIC ACID OXIDATION

Pyruvic acid does not enter directly into krebs cycle.It is decarboxylated and oxidized into acetic acid.

KREBS CYCLE

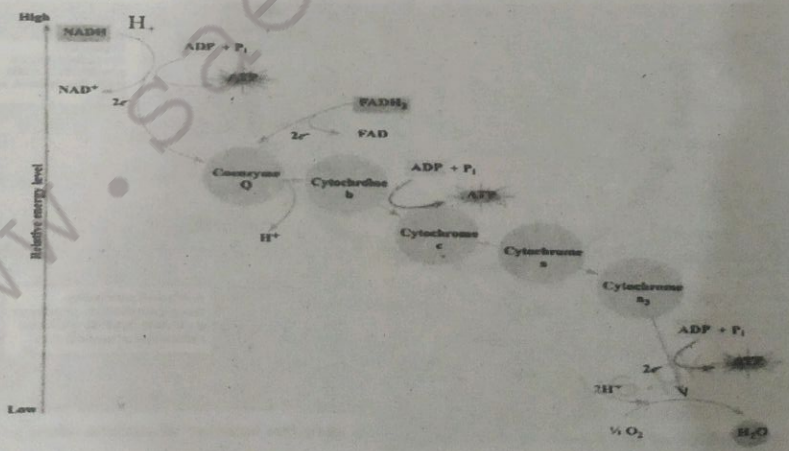
- It is also called **citric acid cycle**.
- Pyruvate enters in Kreb's cycle in form of acetyl co-A.
- **Sequence of reaction** is as
  Acetyl CoA + Oxaloacetate → Citrate → Isocitrate → α-ketogluterate → succinate → Fumarate → Malate → Oxaloacetate
- One Krebs cycle yields 1ATP, 3NADH and 1 $FADH_2$.



ELECTRON TRANSPORT CHAIN

- A system where electrons are transported in a series of oxidation – reduction steps to react ultimately, with molecular oxygen is called **electron transport system or respiratory chain**.
- **Sequence of electron flow** is as follows:

  Coenzyme Q →Cytochrome b → Cytochrome c → Cytochrome a → Cytochrome a



OXIDATIVE PHOSPHORYLATION

Synthesis of ATP in the presence of O_2 is called **oxidative phosphorylation**.

- During **oxidative phosphorylation**, 3 ATPs are formed from one NADH and two ATPs are formed from one $FADH_2$.
- Oxidative phosphorylation is coupled with respiratory chain in the inner membrane of mitochondrion.
- As compared to photosynthesis, here pumping of protons (H+) is across the inner membrane of mitochondrion folded into cristae, between matrix of mitochondrion and mitochondrion's intermembrane space.

CALCULATIONS

STEPS	ATP	NADH	$FADH_2$	CO_2
Glycolysis x 1	4 x 1	2 x 1	-	-
Pyruvate Oxidation x 2	-	1 x 2	-	1 x 2
Krebs Cycle x 2	1 x 2	3 x 2	1 x 2	2 x 2
Total	6	10	2	6
ATP CALCULATION	**6 x 1**	**10 x 3**	**2 x 2**	-
	6	**30**	**4**	
		40		

i. Total ATP produced = 40

ii. Net ATP produced in eukaryotes = 36
- 2 utilized in glycolysis
- 2 utilized in NADH pumping

iii. Net ATP produced in prokaryotes = 38
- 2 utilized in glycolysis

MCQs BIOENERGETICS

1. **Which group differs in chlorophyll b as compared with a:**
   A) CH_3 is replaced by CHO
   B) CHO is replaced by CH_3
   C) NH_2 is replaced by PO_4
   D) C_2H_5 is replaced by CHO
2. **Chlorophyll a shows absorption peak at:**
   A) 430nm, 670nm B) 400nm, 700nm C) 350nm, 600nm D) None of these
3. **Chlorophylls absorb mainly:**
   A) Violet-blue B) Organ-Red C) Both a & b D) Yellow – Green
4. **Action spectrum is different from absorption spectrum of chlorophylls as:**
   A) It have different peaks
   B) It have difference in depth of valley
   C) It is obtain by using bacteria
   D) All of these
5. **Engelmann used which of these to estimate amount of O_2 evolved?**
   A) Pigments
   B) Photo spectrometer
   C) Indicators
   D) Bacteria
6. **Engelmann obtained the:**
   A) Absorption spectrum
   B) Action spectrum
   C) Both a & b
   D) Rate of photosynthesis
7. **Which is red to orange and yellow:**
   A) Chl. A B) Chl. B C) Carotenoids D) Xanthophylls
8. **Thylakoid membrane contains:**
   A) Chlorophylls B) Xanthophylls C) Carotenes D) All of these
9. **How many electrons flow from single molecule of H_2O to reduce NADP?**
   A) 2 B) 3 C) 4 D) 1
10. **Where the proton gradient develops in chemiosmosis:**
    A) Across the thylakoid membrane
    B) Across inner mitochondrial membrane
    C) Both a & b
    D) Across outer mitochondrial membrane
11. **What is a copper containing protein:**
    A) Cytochrome B) Plastoquinone C) Plastocyanin D) Fd
12. **Energy capturing process in plants is:**
    A) Photorespiration B) Light reaction C) Dark reaction D) Glycolysis
13. **Earth is powered by:**
    A) Photosynthesis B) Plants C) Sun D) None
14. **Splitting of water during photosynthesis is called:**
    A) Hydrolysis B) Photolysis C) Phosphorylation D) None
15. **During cyclic photophosphorylation energy molecules are obtained in the form of:**
    A) ADP B) ATP C) GTP D) ATP & $NADPH_2$
16. **How many CO_2 molecules are inserted into one Calvin cycle per RUBP:**

A) 1 B) 2 C) 3 D) 4

17. **Most abundant protein on earth:**
A) Cellulose B) Rubisco C) Actin D) Myosin

18. **What kind of fermentation is carried out by muscle cells:**
A) Alcohol B) Lactic acid C) Citric acid D) Fumaric acid

19. **Glycolysis takes place in:**
A)Mitochondria B) Cytoplasm C)Both D) Chloroplast

20. **Two hydrogen or two electrons are removed in which step of glycolysis:**
A)Preparatory B) Assimilatory C) Oxidative D)None of these

21. **Oxidation process of removal of hydrogen is catalyzed by:**
A) Oxidase B) Reductase C) Dehydrogenase D) Peroxidase

22. **Which conversion is accompanied by free energy change during Krebs cycle?**
A) Succinate – Fumarate C) Fumarate – malate
B) Ketoglutarate- succinate D) Malate – oxalo acetate

23. **Cytochromes are electron transport intermediates containing Haem related:**
A) Coenzymes B) Prosthetic group C) Activator D) None of these

24. **$C_3H_6O_3$ is:**
A) Pyruvic acid B) Lactic acid C) Ethyl alcohol D) Acetyl CoA

25. **Pyruvic acid is consumed by how many ways in different kinds of respiration:**
A) 2 B) 3 C) 4 D) 6

26. **ATP → ADP + Pi; this would release:**
A) 7300 k cal B) 7.3 k cal C) Both D) 8400 cal

27. **Single glucose molecule yields how many ATPs directly from Krebs cycle:**
A) 30 B) 24 C) 12 D) None

28. **In which movement of electrons energy is released to yield an ATP:**
A) NADH →Co Q B) Cyt c→cyta C) Cyt a→ cyt a_3 D) All of these

29. **Cytochrome a_3 is reduced by:**
A) Oxygen B) Cytochrome c C) Cytochrome Q D) None

30. **During oxidation of pyruvic acid, it is 1st converted into:**
A) Acetic acid B) Ethyl alcohol C) Lactic acid D) Acetyl CoA

31. **Oxygen is actually required for:**
A) Oxidation of acetyl CoA C) Oxidation of $FADH_2$
B) Oxidation of NADH D) Both b & c

32. **Splitting of sugar is literally relates to:**
A) Respiration B) Photorespiration C) Glycolysis D) Pyruvic acid

33. **Electron transport intermediate is:**
A) Cytochrome b B) Cytochrome c C) Cytochrome a D) All of above

34. **Oxidative phosphorylation is the synthesis of _____ in the presence of oxygen:**

A) ATP B) Glucose C) Sugars D) Chloroplast

35. The end product of glycolysis is:

A) Pyruvate B) Pyruvic acid C) Lactate D) Both a and b

36. Following is correct sequence of energy transfer between photosynthetic pigments?

A) Chl.a ....> chl.b ....> carotenoids
B) Chl.b ....> carotenoids....> chl.a
C) Carotenoids.....> chl.b ....> chl.a
D) In any direction

37. Conversion of light energy into chemical energy is function of?

A) Mitochondria
B) Stroma of chloroplast
C) Cytoplasm
D) Grana

38. All of the following are differences between chl.a and b except?

A) Chl a has different types while chl.b has single type
B) Chl.a has functional group CHO but b have CH3
C) Chl.a is necessary pigment but b is accessory pigment
D) Chl.a is present in antenna complex while chl.b is in reaction centre

39. Light energy is converted into chemical energy through the formation of?

A) $NADPH_2$ B) ATP C) ATP and NADPH2 D) RuBP

40. Which of the following is the correct sequence of electron transport chain?

A) Cytochrome b,c,a,a3
B) Cytochromes c,b,a3,a
C) Cytochromes a3,b,c,a
D) Cytochromes a,a3,b,c

Answers:

1.	A	2.	A	3.	C	4.	B	5.	D	6.	B	7.	C	8.	D	9.	A	10.	C
11.	C	12.	B	13.	C	14.	B	15.	B	16.	C	17.	B	18.	B	19.	B	20.	C
21.	C	22.	B	23.	B	24.	B	25.	B	26.	B	27.	B	28.	A	29.	D	30.	D
31.	D	32.	C	33.	D	34.	A	35.	D	36.	A	37.	D	38.	D	39.	C	40.	A

ASSESS YOURSELF

1. **Oxidative phosphorylation, synthesis of ATP in presence of oxygen occurs in:**
   A) All types of cells
   B) All anaerobic cells
   C) All primitive cells
   D) All aerobic cells
2. **Glycolysis is the breakdown of glucose into molecules of:**
   A) Glycertae
   B) Lactic acid
   C) Pyruvate
   D) Succinic acid
3. **Before entering into Krebs cycle, the pyruvate is first decarboxylated and oxidized into**
   A) Alpha ketoglutaric acid
   B) Citric acid
   C) Glyceric acid
   D) Acetic acid
4. **Some electrons from second primary electron acceptor may pass back to chlorophyll molecule by electron carrier system yielding ATP, this process is:**
   A) Phosphorylation
   B) Photophosphorylation
   C) Non-Cyclic phosphorylation
   D) Cyclic phosphorylation
5. **Z-scheme is used for:**
   A) Non-cyclic phosphorylation
   B) Cyclic phosphorylation
   C) Both(A) and (B)
   D) Oxidative phosphorylation
6. **The product(s) of cyclic phosphorylation is/are:**
   A) ATP
   B) NADP
   C) NADP and ATP
   D) NADP, ATP and oxygen
7. **Total NADH formed by one glucose molecule during Krebs'scycle are:**
   A) 6
   B) 3
   C) 8
   D) 18
8. **The terminal electron acceptor in electron transport chain is:**
   A) Hydrogen
   B) Iron
   C) Cytochrome
   D) Oxygen
9. **The end product of glycolysis is:**
   A) ADP
   B) Reduced FAD
   C) Citric acid
   D) Pyruvate
10. **One molecule of $FADH_2$ is produced in Krebs cycle during conversion of:**
    A) Fumarate to malate
    B) Succinate to fumarate
    C) Malate to oxaloacetate
    D) Alpha ketoglutarate to succinate
11. **Every molecule of NADH, fed into ETC produces?**
    A) 2ATP
    B) 3ATP
    C) 4ATP
    D) 6ATP
12. **Final acceptor of electrons in respiratory chain is:**
    A) Cytochrome A
    B) Oxygen
    C) Cytochrome a_3
    D) Cytochrome C
13. **The end product of anaerobic respiration in humans and other mammals is:**
    A) Pyruvic acid
    B) Ethanol
    C) Lactic acid
    D) Glucose
14. **A biochemical process which occurs within a cell to breakdown complex compounds to produce energy is called:**
    A) Respiration
    B) Photosynthesis
    C) Oxidation reduction
    D) Photophosphorylation
15. **Which part of chlorophyll molecule absorbs light?**
    A) Phytol
    B) Porphyrin ring
    C) Pyrrole
    D) Thylakoid membrane

16. Light energy is converted into chemical energy through the formation of?
A) $NADPH_2$ B) ATP C) ATP and NADPH2 D) RuBP

17. Which of the following is the correct sequence of electron transport chain?
A) Cytochrome b,c,a,a3
B) Cytochromes c,b,a3,a
C) Cytochromes a3,b,c,a
D) Cytochromes a,a3,b,c

18. How many FADH2 molecules are formed during krebs cycle of one glucose molecule?
A) 1 B) 2 C) 3 D) 4

19. During the respiratory chain of FADH2. molecule of ATP is formed at the stage of?
A) Coenzyme Q to cytochrome b
B) Cytochrome c to cytochrome a
C) Cytochrome b to cytochrome c
D) Cytochrome a to cytochrome a3

20. Which one of the following molecules of respiratory chain is found at the lowest energy level?
A) Cytochrome a
B) Cytochrome b
C) Cytochrome a3
D) Coenzyme Q

21. During the krebs cycle of one pyruvate NADH and FADH2 are produced. How many molecules of ATP are formed from all the NADH and FADH2 produced from one pyruvate krebs cycle?
A) 9 B) 10 C) 11 D) 12

22. FADH 2 is produced during the conversion of?
A) 4C molecule (oxaloacetate) ....> 6C molecule (citrate)
B) 6C molecule (isocitrate) .....> 5C molecule (@-ketoglutarate)
C) 4C molecule (fumarate) ....> 4C molecule(malate)
D) 4C molecule (succinate) .....> 4C molecule (fumarate)

23. How many ATPs are formed from one NADH during ETC?
A) 1 B) 2 C) 3 D) 4

24. Which group is common in cyclic and non cyclic phosphorylation?
A) Plastoqunine, cytochrome complex, ferridoxin
B) Plastocyanin, cytochrome complex, plastoqunine
C) Ferridoxin, plastocyanine, plastoqunine
D) Cytochrome complex, plastocyanine, ferridoxin

25. NADP+ reductase accept electron from?
A) Plastoqunine
B) Ferridoxin
C) Cytochrome complex
D) Plastocyanin

26. During the conversion of pyruvate into Acetyl-CoA, which of the following reactions are occurring?
A) Release of O2
B) Formation of ATP
C) Formation of NADH
D) Synthesis of both NADH and FADH2

27. Coenzyme NAD+ is
A) Mono nucleotide
B) Di nucleotide
C) Tri nucleotide
D) None of these

28. The final acceptor of electrons in the respiratoy chain is?
A) Cytochrome a B) Cytochrome a3 C) Cytochrome b D) Oxygen

29. The end product of anaerobic respiration in humans and other mammals is?

A) Pyruvic acid B) Ethanol C) Lactic acid D) Glucose

30. **Which part of chlorophyll molecule absorbs light?**
A) Phytol B) Porphyrrin ring C) Pyrole D) Thylakoid membrane

31. **Every molecule of FADH2 , fed into ETC produces**
A) 2 ATP B) 3 ATP C) 4 ATP D) 6 ATP

32. $C_{55}H_{72}O_5N_4Mg$ **is the formula of**
A) Chl.a B) Chl.b C) Chl.c D) Carotenoids

33. **Oxygen is released during**
A) Photolysis B) Electron transport C) Phosphorylation D) Carboxylation

34. **Which is called Z-scheme**
A) Light reaction B) Dark reaction C) Both D) None

35. **ATP synthase is part of?**
A) Intergranum B) Proton channel C) Stroma D) None of these

36. **Calvin cycle takes place in**
A) Thylakoid interior C) Stroma
B) Outer membrane D) Inner membrane

37. **Which resemble haeme group**
A) Phytol B) Pyrrole C) Porphyrin D) None of these

38. **Visible light ranges from**
A) 200nm – 700 nm C) 400nm -500nm
B) 380nm -750 nm D) 200nm -600 nm

39. **Out of _____molecules of G3P only one leaves the calvin cycle**
A) 6 B) 4 C) 5 D) 8

40. **Most abundant protein on earth**
A) Cellulose B) Actin C) Rubisco D) Myosin

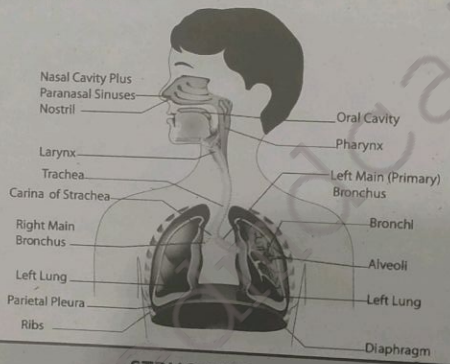
CHAPTER 05

GAS EXCHANGE

COURSE CONTENT

- Anatomy of Human Respiratory System.
- Transport of Respiratory Gases: O_2 & CO_2 and Role of Haemoglobin as Respiratory Pigment.
- Respiratory Disorders: Tuberculosis, Emphysema and Lung Cancer

ANATOMY OF RESPIRATORY SYSTEM



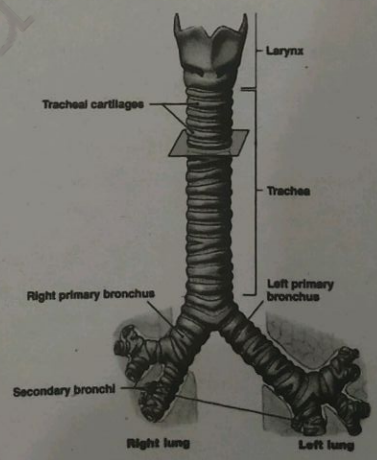
COMPONENT	STRUCTURE	FUNCTION
Nostrils and nasal cavities (two in number)	Each subdivided into three passage ways by projection of bones from wall of internal nose, mucus secreting cells.	Filtration, moistening and warming of air
Pharynx or throat	Muscular passage lined with mucous membrane	Channelizes air to larynx
Larynx (voice box)	Complex cartilaginous structure, upper end of trachea	Takes air from pharynx
	Glottis cartilaginous structure, upper end of trachea	Vocal organ
	Epiglottis: cartilaginous, covering of glottis, muscularly controlled hinge bands	Covers glottis during swallowing
	Vocal cards: stretched mucous membrane in two thin edges of fibrous bands	Voice production by vibration through air
Trachea: Tubular, ventral to esophagus, windpipe	C-shaped cartilage rings, inner lining of ciliated and mucous cells	Cartilage rings prevent collapse of trachea, ultimate cleaning of air
Bronchi (2 in number)	Irregularly distributed cartilage plates	Transfer of air

Bronchioles	Diameter of 1 mm or less, no cartilage, only smooth muscles	Transfer of air
Air sacs	Several microscopic single layered structure called alveoli	Functional unit of lungs
Alveoli	Single layered surrounded by blood capillaries	Gaseous exchange

Lungs

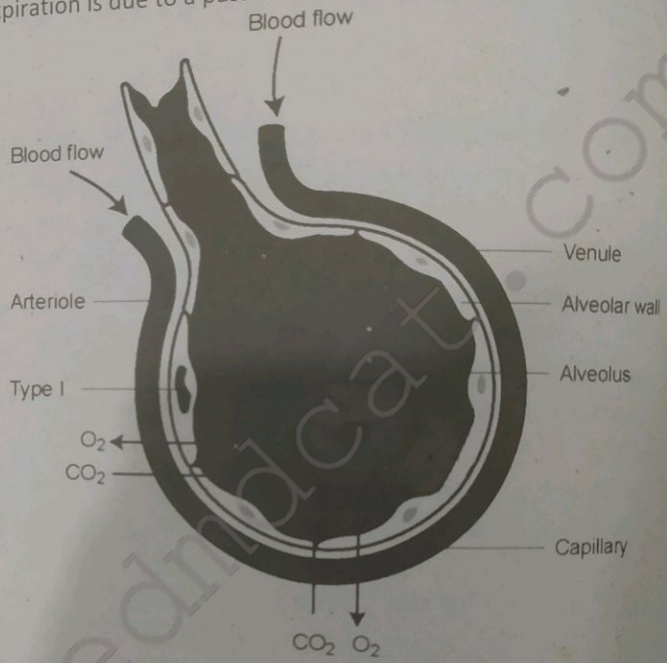
- In human beings the Air passage ways consist of
- Nostrils,
- Nasal cavities,
- Pharynx,
- Larynx,
- Trachea,
- Bronchi,
- Bronchioles
- Alveolar ducts which lead into the alveolar sac.
- Nasal cavities are lined by mucous membrane of the ciliated epithelium.
- The larynx or voice box is a complex cartilaginous structure surrounding the upper end of the trachea. The opening of larynx is called glottis. It is also lined by mucous membrane.

- The epiglottis is a lid which automatically covers the opening of the larynx during swallowing. Epiglottis is a cartilaginous structure. It is muscularly controlled. It has a hinge like action.
- In the glottis, the mucous membrane is stretched across into two thin edged fibrous bands called vocal cords. These help in the voice production, when vibrated by air.
- The trachea or wind pipe is ventral to the oesophagus.
- Each bronchus on entering the lung divides and subdivides progressively into smaller and smaller bronchi. **When the smaller bronchi attain a diameter of one mm or less, then they are called bronchioles.** The bronchioles totally lack cartilages. Bronchioles are made up of mainly circular smooth muscles.



- The bronchioles continue to divide and subdivide and finally open into a large number of air-sacs. **Air-sac is the functional unit of the lungs.** Each air-sac consists of several microscopic single layered structures called alveoli. Overlying the alveoli, there is a rich network of blood capillaries. It is an excellent site for the exchange of gases.
- Chest cavity is bounded by ribs and muscles on the sides. **The floor of the chest is called diaphragm.**
- Diaphragm is a sheet of skeletal muscles.
- **Lungs are covered with double layered thin membranous sacs called pleura.**

- Breathing is a process in which fresh air containing more oxygen is pumped into the lungs and air with more carbon dioxide is pumped out of the lungs.
- Breathing is a mechanical process consisting of two phases, **inspiration and expiration.**
- **During rest, breathing occurs rhythmically at the frequency of 15 to 20 times per minute in humans.**
- Lungs are spongy in nature. They never pull air in or push it out. Inspiration is due to passive expansion of elastic lungs while expiration is due to a passive contraction of lungs.
- The shape of the diaphragm is **more domelike** when its muscles are relaxed. On the other hand the shape of the diaphragm is **less domelike** when its muscles are contracted.
- Walls of the chest cavity are composed of ribs and intercostal muscles. When muscles between the ribs contract, the ribs are elevated and when muscles between ribs are relaxed, the ribs settle down.



- **During inhalation there is contraction of rib muscles and the muscles of diaphragm.**
- **Respiratory distress syndrome** occurs because enough surfactant is not produced to reduce the tendency of the lungs to collapse. It is common in premature infants especially in infants with a gestation age of less than 7 months.

BREATHING

- Breathing is a mechanical process by which fresh air containing oxygen is pumped into the lungs and air with more carbon dioxide is pumped out of lungs.
- Normal breathing rate is 15-20 breaths/min and it can increase to 30 breaths / min during exercise.

PHASES OF BREATHING

FEATURE	INSPIRATION	EXPIRATION
Other Name	Inhalation	Exhalation
Basic Mechanism	Passive expansion of lungs	Passive contraction of lungs
Definition	Taking in of air into the lungs	Removal of air from lungs outside body

Diaphragm	Contracts, moves down, becomes less dome-like	Relaxes, moves up, become more dome-like
Rib muscles	Contract	Relax
Rib cage	Moves upward and forward	Moves downward and inward
Volume of thorax	Increases	Decreases
Pressure on lungs.	Decreases	Increases
Air moves	Into lungs	Out of lungs

❖ TRANSPORT OF OXYGEN

- Most of the oxygen is transported **through haemoglobin.**
- A small proportion is transported through plasma in dissolved form.
- Haemoglobin acts as an efficient oxygen carrier.
- Haemoglobin readily combines with oxygen to form bright red oxyhaemoglobin.
- **Maximum capacity** of haemoglobin to carry oxygen is about 20ml/100ml of blood at sea level. At this blood will be 100% saturated.
- Under normal conditions, blood of alveoli of lungs is not completely oxygenated.
- **At 115 mmHg** oxygen tension, there is 19.6ml/100ml of blood, where it is 98% saturated.
- Oxyhaemoglobin is unstable and splits into the normal purple red haemoglobin and oxygen in the condition of low oxygen concentration and low pressure.
- Carbonic anhydrase enzyme present in RBC facilitates this activity.
- $HbO_2 \xrightarrow{\text{Carbonic Anhydrase}} Hb + O_2$

❖ FACTORS AFFECTING O_2 HOLDING CAPACITY OF HAEMOGLOBIN

✓ **Carbon Dioxide**

- When carbon dioxide pressure increases, the oxygen tension decreases, the capacity to hold oxygen becomes less.

✓ **Temperature**

- Rise in temperature causes a decrease in oxygen carrying capacity of blood.

✓ **pH**

- With decrease in pH of blood, amount of oxygen bound to haemoglobin also declines.
- Decreased pH results from increase in hydrogen ions. Hydrogen ions combine with the protein part of heamoglobin molecules causing a decrease in its ability to bind oxygen.

❖ TRANSPORT OF CARBON DIOXIDE

- Carbon dioxide is more soluble than oxygen.
- CO_2 is much more important than oxygen as a regulator of normal alveolar ventilation (breathing).

20%	Carboxyhemoglobin
5%	Plasma Proteins
70%	Bicarbonate ions combined with sodium in plasma.
Small Amount	By corpuscles combined with potassium

- **Arterial blood contains about 50ml of CO_2/100ml of blood.**

- **Venous blood contains 54ml of CO2/100ml of blood.**
- Each 100ml of blood takes 4ml of carbon dioxide as it passes through the tissues and gives 4ml of CO_2 as it passes through lungs.

✓ **RESPIRATORY PIGMENTS**

- Two respiratory pigments are important in humans i.e. haemoglobin and myoglobin.
- **Heamoglobin** increases oxygen carrying capacity of blood to about 75 times.
- **Myoglobin** is also called **muscle hemoglobin.**

FEATURES	HAEMOGLOBIN	MYOGLOBIN
Location	Blood	Muscles
Oxygen Transfer	It transfers oxygen from lungs to blood and then to tissues.	It transfers oxygen from haemoglobin to aerobic respiring muscle cells.
Oxygen Storage	It cannot store oxygen.	It can store oxygen.
Structure	It consists of four polypeptide chains each associated with an iron containing haem group.	It consists of one polypeptide chain associated with an iron containing haeme structure.
Capacity for Oxygen	More	Less
Affinity with Oxygen	Less	More
O_2molecules Bound	Four	One

RESPIRATORY DISORDERS

FEATURES	TUBERCULOSIS	EMPHYSEMA	CANCER
Disease	Infectious disorder of respiratory system	Breakdown of alveoli	Lung malignant tumor of potentially unlimited growth
Cause	Mycobacterium , Malnutrition, Poorliving conditions	Smoking	Smoking (90%) Other pollutants
Pathogenesis	Contagious disease Lung damage Cough & fever	• Weakens the wall of alveoli, absorbing surface of lung is reduced, increased airway resistant.	Malignant tumor local expansion by invasion and systemic by metastasis Occlusion of respiratory passage
Treatment	Medicine	No smoking, Antibiotics	Chemotherapy & Radiotherapy

MCQ's OF GAS EXCHANGE

1. **What is the functional unit of lungs in mammals:**
   A) Alveoli B) Air sacs C) Bronchioles D) Parabronchi
2. **Small amount of carbon dioxide is also carried by corpuscles combined with:**
   A) Fe B) Mg C) Na D) K
3. **Which stores oxygen**
   A) Haemoglobin B) Myoglobin C) Biliglobin D) All Cetaceans
4. **How much air is held by human lungs when they are fully inflated?**
   A) 3.5litres B) 4.5litres C) 5litres D) 4litres
5. **Diaphragm is a sheet of:**
   A) Smooth muscles B) Skeletal Muscles C) Cardiac Muscles D) Connective tissues
6. **Walls of the chest cavity are formed by:**
   A) Diaphragm B) Ribs C) Intercostal muscles D) Both B & C
7. **No. of polypeptides in myoglobin:**
   A) 2 B) 6 C) 8 D) 1
8. **Carbonic anhydrase is present in:**
   A) Blood plasma B) R.B.C. C) Lymphocytes D) W.B.C.
9. **O_2 affinity of hemoglobin increase when:**
   A) pH decreases C) CO_2 increases
   B) Temperature decreases D) None
10. **Each nasal cavity is subdivided into passage ways:**
    A) 3 B) 4 C) 6 D) 2
11. **Which is not lined by mucous membrane**
    A) Esophagus B) Pharynx C) Nasal cavity D) None of these
12. **%age of nitrogen in exhaled air:**
    A) 21% B) 70% C) 79% D) 4%
13. **Organismic respiration is also known as:**
    A) Breathing B) Ventilation C) Both A & B D) None
14. **In human beings, CO2 concentration in the inspired and expired air is respectively?**
    A) 0.0% and 5.3 % B) 0.4 % and 5.0 % C) 0.04 % and 4.0 % D) 0.03 % and 4.0 %
15. **Air enters into the lungs through?**
    A) Trachea >lungs> larynx>pharynx>alveoli
    B) Nose>larynx>pharynx>bronchus>alveoli>bronchioles
    C) Nostrils>pharynx>larynx>trachea>bronchi>bronchioles>alveoli
    D) Nose>mouth>kidney
16. **All of the following play a protective role in respiratory passage except?**
    A) Macrophages B) Hair and mucous C) Ciliated epitheliumD) Lymphocytes
17. **It is now estimated that 90% of lung cancer is caused by?**
    A) Air pollution B) Genetically C) Oncovirus D) Smoking
18. **Nasal cavity is lined with?**
    A) Columnar epithelium C) Squamous epithelium
    B) Ciliated epithelium D) Cuboidal epithelium
19. **Trachea lies ..... To the esophagus?**
    A) Dorsal B) Ventral C) Median D) Lateral

20. **Breakdown of the wall of alveoli is called?**
A) Asthma B) Cancer C) Emphysema D) Tuberculosis

21. **Which of these doesn't cause the change in volume of lungs?**
A) Diaphragm B) Ribs C) Pleura D) Intercostal muscles

22. **$HCO_3 + H^+ \longrightarrow H_2CO_3 \longrightarrow CO_2 + H_2O$. It occurs when blood circulates through:**
A) Alveolar capillaries
B) Capillary bed of body
C) Arterial system
D) Venous system

23. **A process in which fresh air containing more oxygen is pumped into the lungs and air with more carbon dioxide is pumped out of the lungs out of the lungs is called:**
A) Cellular respiration B) Internal respirationC) Breathing D) Assimilation

24. **The capacity of hemoglobin to combine with oxygen is affected by the following EXCEPT:**
A) Carbon dioxide pressure
B) Temperature of the blood
C) pH of the blood
D) Nitrogen pressure

25. **The CO_2 carried as bicarbonate ion is _____ of the total CO_2 carried by human blood:**
A) 5% B) 70% C) 20% D) 5%

26. **Lungs are placed in:**
A) Pleural cavity B) Chest cavity C) Thoracic cavity D) All A,B,C

27. **Respiratory distress syndrome is common especially for infants with a**
A) Less than 7 month
B) Less than 9 month
C) Less than 8 month
D) More than 9 month

28. **Diaphragm is a sheet of:**
A) Smooth muscles B) Skeletal muscles C) Circular muscles D) Cardiac muscles

29. **Normally at rest we inhale and exhale:**
A) 15 – 20 times per minutes
B) 30 times per minutes
C) 20 – 30 times per minutes
D) 10 – 15 times per minutes

30. **There is a little change in the composition of inhaled and exhaled air during rest or exercise in:**
A) One constituent of air
B) Two constituents of air
C) Most of the constituents of air
D) Few constituents of air

31. **It is more common in poor people:**
A) Cancer B) Asthma C) Emphysema D) Tuberculosis

32. **Following are the symptoms of tuberculosis EXCEPT:**
A) Cough
B) Fever
C) Paroxysm of difficult breathing
D) Weakness

33. **A malignant tumor have a potential of:**
A) Limited growth B) Unlimited growth C) Local growth D) Widespread growth

34. **Haemoglobin in man increases the oxygen carrying capacity of the blood to about:**
A) 50 times B) 75 times C) 60 times D) 90 times

35. **Myoglobin is hemoglobin like iron containing protein pigment occurring in:**
A) Muscle fibers B) Nerve cells C) Bone cells D) Liver cells

36. **It serves as an intermediate compound for the transfer of oxygen from hemoglobin to aerobic metabolic processes of the muscles cells:**
A) Blood plasma
C) Myoglobin

37. **When an oxygen tension is 115mm of mercury, hemoglobin is _____ percent:**
A) 96 B) 97 C) 98 D) 99

38. **The opening of larynx is called:**
A) Nostril B) Nares C) Glottis D) Epiglottis

39. **The closed sac type organs that are connected to the outside by way of the trachea and the nostrils or mouth are:**
A) Air sacs B) Alveoli C) Thorax D) Lungs

40. **What helps in voice production, when vibrated by air:**
A) Larynx B) Voice box C) Vocal cords D) Pharynx

Answers:

1.	B	2.	D	3.	B	4.	C	5.	B	6.	D	7.	D	8.	B	9.	A	10.	A
11.	D	12.	C	13.	C	14.	C	15.	C	16.	D	17.	D	18.	B	19.	B	20.	C
21.	C	22.	A	23.	C	24.	D	25.	B	26.	D	27.	A	28.	B	29.	A	30.	C
31	D	32	C	33	B	34	B	35	A	36	C	37	C	38	C	39	D	40	C

A) 8 months B) 7 months C) More than 7 months D) Less than 7 months

18 **Ability of hemogleobin to bind oxygen is directly proportional to:**
A) Temperature of the blood
B) CO_2 conc. In blood
C) pH of the blood
D) H^+ ion conc. In the blood

19 **Respiratory distress syndrome is common especially for:**
A) Premature children
B) Mature children
C) Infants
D) Premature infants

20 **Deficiency of surfactant in infants results in:**
A) Asthma
B) Respiratory distress syndrome
C) Emphysema
D) Sinusitus

21 **Respiratory distress syndrome occurs due to:**
A) Change in number of alveoli
B) Decrease in surface area of alveoli
C) Permeability problem of alveolar epithelium
D) Secretory deficiency of alveolar epithelium

22 **An enzyme that is involved in dissociation of oxygen from hemoglobin is called:**
A) Carboxylase B) Anhydrase C) Oxygenase D) Deoxygenase

23 **These are lined with mucous membrane of ciliated epithelium and are separated from cacn other by a septum:**
A) Bronchi B) Bronchioles C) Nasal cavities D) Alveoli

24 **Blood vessels running parallel to the Bronchi is/are called:**
A) Pulmonary artery
B) Pulmonary vein
C) Pulmonary arteriole
D) Pulmonary arteriole and Pulmonary vein

25 **Each bronchus on entering the lung divides and sub divides progressively into smaller and smaller:**
A) Bronchioles
B) Bronchi
C) Alveolar ducts
D) Tracheoles

26 **Hemoglobin readily combines with oxygen to form:**
A) Bright red oxyhemoglobin
B) Purple red oxyhemoglobin
C) Bright red hemoglobin
D) Purple red hemoglobin

27 **Hemoglobin can be almost completely oxygenated by an oxygen pressure of:**
A) 98 mm mercury
B) 60 mm mercury
C) 100 mm mercury
D) 99 mm mercury

28 $CO_2 + H_2O \xrightarrow[\text{anhydrase}]{\text{carbonic}} H_2CO_3 \longrightarrow H^+ + HCO^-3$. **It happens when blood circulates through:**
A) Alveolar capillaries
B) Capillary bed of body
C) Arterial system
D) Venous system

29 **What determine the degree of closure of glottis during swallowing:**
A) Forward movement of tongue
B) Downward movement of tongue
C) Upward movement of the larynx
D) downward movement of the larynx

30 **As the blood passes through the tissues, how much carbon dioxide is carried by it per 100ml of blood:**
A) 20ml B) 50ml C) 54ml D) 4ml

31 **When muscles of diaphragm contract it becomes:**
A) More dome like
B) Less dome like
C) Less flat
D) More flat and less dome like

ASSESS YOURSELF

1 **Air passageways ultimately lead into the:**
A) Alveolar sacs B) Air sacs C) Bronchi D) Bronchioles

2 **Each nasal cavity is sub-divided into:**
A) Two passageways C) Four passageways
B) Three passageways D) Five passageways

3 **Large dust particles are trapped by the hair and mucus in the:**
A) Nostrils B) Nasal cavities C) Pharynx D) Nose

4 **It is a complete cartilaginous structure surrounding the upper end of the trachea:**
A) Trachea B) Glottis C) Larynx D) Wind pipe

5 **The opening of larynx is called:**
A) Nostril B) Nares C) Glottis D) Epiglottis

6 **What helps in voice production, when vibrated by air:**
A) Larynx B) Voice box C) Vocal cords D) Pharynx

7 **What determine the degree of closure of glottis during swallowing:**
A) Forward movement of tongue C) Upward movement of the larynx
B) Downward movement of tongue D) Downward movement of the larynx

8 **Food does not enter the partly open larynx because:**
A) Epiglottis closes the glottis
B) Esophageal sphincter closes the glottis
C) Epiglottis diverts the food mass to one side of glottis
D) Epiglottis stops the food to move further down

9 **The trachea or wind pipe extends to the:**
A) Lungs B) Pleural cavity C) Chest cavity or thorax D) Abdominal cavity

10 **In the wall of trachea there are a series of:**
A) C – shaped cartilaginous rings C) C – shaped muscular rings
B) U – shaped cartilaginous rings D) U – shaped muscular rings

11 **Voice box of human being is called:**
A) Larynx B) Pharynx C) Bronchus D) Syrinx

12 **It is the functional unit of lungs:**
A) Air sacs B) Alveoli C) Bronchioles D) Bronchi

13 **Overlying the alveoli there is a rich network of:**
A) Blood capillaries B) Bronchioles C) Bronchi D) Smooth muscles

14 **The part of the thoracic cavity containing the lungs is lined by:**
A) Ribs B) Diaphragm C) Pleural membranes D) Pleural fluid

15 **The closed sac type organs that are connected to the outside by way of the trachea and the nostrils or mouth are:**
A) Air sacs B) Alveoli C) Thorax D) Lungs

16 **Pressure inside the chest cavity is reduced by:**
A) Downward movement of diaphragm
B) Upward movement of diaphragm
C) Upward movement of the ribs
D) Downward movement of the diaphragm and upward movement of ribs

7 **Premature infants suffering from respiratory distress syndrome have completed a gestation age of:**

32 **The lung cancer is _____ times more in those persons who smoke or live in smoky and congested areas as compared to those who do not smoke:**
A) Ten B) Twenty C) Fifteen D) Five

33 **Percentage of oxygen in exhaled air is:**
A) 21 B) 16 C) 0.04 D) 4.0

34 **A disease of longs in which inside of the lungs is damaged resulting in cough and fever:**
A) Lung cancer B) Emphysema C) Asthma D) Pulmonary tuberculosis

35 **Of the following, which one is a contagious disease?**
A) Tuberculosis B) Asthma C) Lungs cancer D) Emphysema

36 **Deoxygenated blood means:**
A) Blood without O_2
B) Blood with less O_2
C) Blood with less CO_2
D) Blood with CO

37 **The component which does not vary in inspired and expired air:**
A) Vapours B) Nitrogen C) CO_2 D) O_2

38 **Percentage of carbon dioxide in exhaled air:**
A) 16% B) 4% C) 21% D) 0.4%

39 **Oxygen Carrying capacity of hemoglobin decrease with:**
A) Decrease in Temperature
B) Increase in pH
C) Decrease in CO_2 Concentration
D) Decrease in pH

40 **Hemoglobin in man increases the oxygen carrying capacity of blood about:**
A) 10 times
B) 25 times
C) 50 times
D) 75 times

CHAPTER 06

TRANSPORT IN PLANTS

COURSE CONTENT

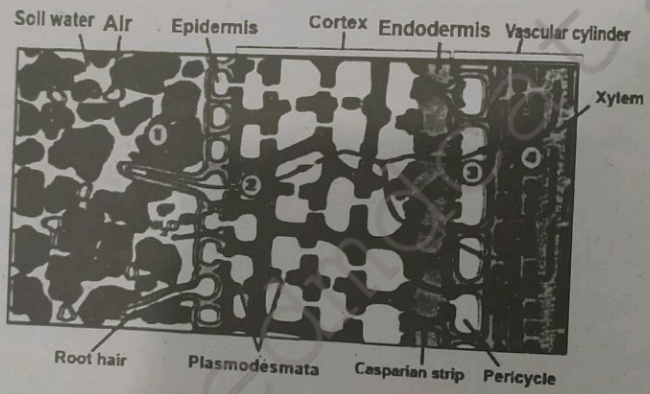
- Transport of Water and Minerals: Apoplast & Symplast Pathway and Cohesion, Transpiration Pull / Tension & Adhesion
- Transpiration, Factors affecting it and opening and closing of Stomata.
- Translocation according to Pressure Flow Theory
- Xerophytes

TRANSPORT IN PLANTS

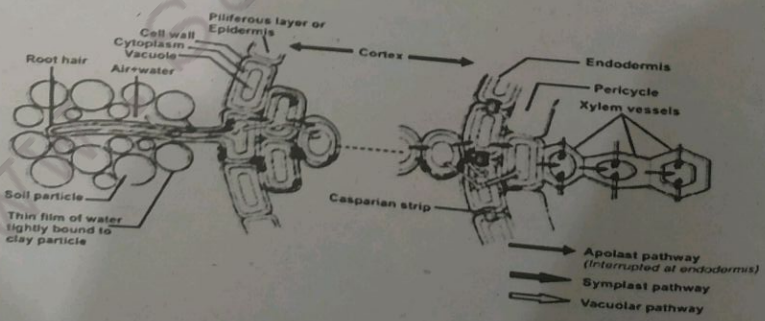
- The roots of a plant not only anchor the plant body in the soil, but also absorb minerals and water from the soil.
- There are three types of nutrients needed by the plants, carbon dioxide, water and minerals besides light to carry out photosynthesis. To get these materials, roots must provide large surface area for absorption, which is achieved by extensive branching.
- The roots bear a dense cluster of tiny hair like structures which are extensions of epidermal cells of roots.
- These are the root hairs, which are in fact the sites where most of the uptake of water and minerals takes place.
- **Prosopis trees of leguminoseae family have maximum depth of their roots, which is 50 metres.**
- **It has been estimated that out of total surface area provided by roots, 67% is provided by the root hairs.**
- The uptake of minerals by root cells a combination of passive uptake and active uptake, involving the use of energy in the form of ATP. The passive uptake involves diffusion.
- The minerals they also move down their concentration gradient through plasmodesmata (symplast pathway) to cells of cortex, endodermis, pericycle and then to sap in xylem cells. From here they are pulled up by transpiration pull to different parts of plant.
- The **diffusion** of ions along with water also takes place by mass flow along the apoplast pathway. Ions moving in the apoplast can only reach the endodermis, where casparian strips prevent further progress to cross the endodermis, ions must pass by diffusion or active transport into endodermis cells, entering their cytoplasm, and possible their vacuoles.
- The ions then reach the xylem cells. Diffusion of ions can also take the vacuolar pathway where the ions move along their concentration gradient through the cell membranes, cytoplasm, and tonoplast (the membrane of vacuoles), and reach the dead xylem cells.
- Most of ions are taken up by the roots by the process of active transport. By this method plants can take a mineral that is in higher concentration inside the root cells than in the soil solution. In this process

molecules and ions move from their low Concentration to their higher concentration (i.e. against the concentration gradient), through cell membrane, by the use of energy in the form of ATP. Active transport is selective and is dependent on respiration. Some ions move by passive as well as by active transport.

- Some nutrients are carried from the soil the soil the epidermal cells of roots through their cell membrane by facilitated diffusion. In the type of diffusion, carrier molecules within the cell membrane transport nutrients across the membrane. These carrier molecules are proteins – which are present within cell membrane of epidermal and other root cells.
- Most of ions are taken up by the roots by the process of active transport. By this method plants can take a mineral that is in higher concentration inside the root cells than in the soil solution. In this process molecules and ions move from their low concentration to their higher concentration (i.e. against the concentration gradient), through cell membrane, by the use of energy in the form of ATP. Active transport is selective and is dependent on respiration. Some ions move by passive as well as by **active transport.**



- Normally, the movement of water molecules from a region of their higher concentration to region of their low concentration through a partially permeable membrane is called **osmosis**. If water moves by osmosis into a cell the process is called **endosmosis**, and if the water moves out of the cell it is called **exosmosis.**



Following are the paths taken by water to reach the xylem tissue

(i) The Apoplast pathway

- It is the pathway involving system of adjacent cell walls which is continuous throughout the plant roots. In the roots apoplast pathway becomes discontinuous in the endodermis due to the presence of casparian strips.

(ii) The Symplast pathway

- It is the system of interconnected protoplasts in the root cells. The cytoplasm of neighboring cells (protoplasts) is connected with one another by ***Plasmodesmata*** which are cytoplasmic strands that extend through pores in adjacent cell walls. In the cells of root the cell membrane and cytoplasm (and plasmodesmata) can be regarded as acting together as one partially permeable membrane.

(iii) The Vacuolar pathway

- In this pathway water moves from vacuole to vacuole through neighbouring cells crossing the symplast and apoplast in the process and moving through cell membranes by osmosis. Water moves passively down a concentration gradient.

ASCENT OF SAP

- Water and dissolved minerals are carried or pulled upwards towards the leaves through xylem tissue. This is called ascent of sap. This may involve the following:

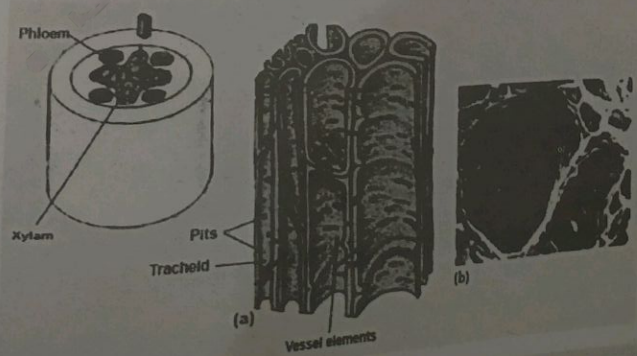
(A) Cohesion Tension Theory **(B) Root Pressure** **(C) Imbibition**

(A) **Cohesion tension theory** is one of the most important theories proposed by **Dixon.** This theory provides a reasonable explanation of flow of water and minerals upwards from the roots to leaves of plants, in bulk flow or mass flow. Thisdepends on the following:

(i) **Cohesion:** It is the attraction among water molecules which hold water together, forming a solid chain – like column within the xylem tubes. The water molecules form hydrogen bonds between them.

(ii) **Tension:** It is provided when this water chain is pulled up in the xylem. Transpiration provides the necessary energy or force. Tension is between the molecules of water by hydrogen bonds.
This xylem water tension is strong enough to pull water up to 200 metres (more than 600 feet) in plants.

(iii) **Adhesion:**It may be added that the water molecules also adhere to the cell walls of xylem cells, so that the column of water in xylem tissue does not break. The composition of cell wall provides necessary adhesion to water molecules that helps water creep up. The ceilulose component of cell wall especially has great affinity for water. It can imbibe water.



Strong xylem walls: It is essential that the xylem walls should have high tensile strength if they are not to buckle inwards. The lignin and cellulose provides strength to cell wall of xylem vessels.

By cohesion – tension of water molecules, and the transpiration pull providing the necessary energy, the sap (water and minerals) in xylem tissue is pulled upwards to the leaves. Large quantities of water are carried at relatively high speed, upto $8mh^{-1}$ being recorded in tall trees, and commonly in other plants at $1mh^{-1}$.

The total water pulled up in the leaves is transpired, except about 1% which is used by plant in various activities including photosynthesis.

anspiration Pull

The evaporation of water from the aerial parts of the plant especially through stomata of leaves is a process called **transpiration.** As a leaf transpires the water potential of its mesophyll cells drops. This drop causes water to move by osmosis from the xylem cells of leaf into dehydrating mesophyll cells. The water molecules leaving the xylem are attached to other water molecules in the same xylem tube by hydrogen bonds (cohesion of water molecules).

Therefore, when one water molecule moves up the xylem, the process continues all the way to the root – where water is pulled from the xylem cells (tracheid's and vessels).

This pull also causes water to move down its concentration gradient transversely from the root epidermis (root hairs) to cortex by endosmosis and to pericycle.

This pulling force or transpiration pull is so strong that it also reduces the water potential of root epidermal cells. Then water in the soil moves from its higher water potential to lower water potential of epidermis of root by osmosis.

OPENING AND CLOSING OF STOMATA

✓ The guard cells function as multisensory hydraulic valves.

There are two hypotheses which may explain the opening and closing of stomata.

i) Starch Sugar Hypothesis

- The German botanist **H. Van Mohl** proposed that the guard cells are the only photosynthesizing cells of epidermis of leaf and sugars are produced in them during day time when light is available.
- When sugar level rises i.e. solute concentration increases or water potential decreases – and the guard cells become turgid due to entry of water and they separate from one another, and stoma or pore opens.
- During night there is no photosynthesis the sugars are either converted into insoluble starch or are used in respiration, this decreases free sugars in cell. So the osmotic pressure of guard cells is lowered, and water leaves the guard cells, which become flaccid and stoma or pore between them closes. But these processes are not fast enough to account for the rapid rise in turgor, of guard cells.

) Influx of K+ ions

Potassium concentration in guard cells increases several fold, depending upon plant species.

Stomata open due to active transport of potassium ions (K^+) into the guard cells from the surrounding epidermis. The accumulation of K^+ decreases the osmotic potential of guard cells.

Water enters the guard cells by osmosis, which become more turgid and stretched and stomata are opened.

The stoma closes by reverse process; involving passive diffusion of K^+ from guard cells followed by water moving out by osmosis.

- Level of carbon dioxide in the spaces inside the leaf and light, control this movement. A low level of carbon dioxide favours opening of the stomata, thus allowing an increased carbon dioxide level and increased rate of photosynthesis.
- **Exposure to blue light, which is also effective in photosynthesis has been shown to acidify the environment of the guard cells (i.e. pumps out protons) which enable the guard cells to take up K^+ followed by water uptake resulting in increased turgidity of guard cells.**
- So in general stoma are open during day and closed at night. This prevents needless loss of water by the plant when it is too dark for photosynthesis.

TYPES OF TRANSPIRATION

(i) Cuticular transpiration
(ii) Lenticular transpiration
(iii) Stomatal transpiration

(i) Cuticular transpiration

- The loss of water in the form of water vapours through the cuticle of leaves is called cuticular transpiration.
- **About 5 to 7 % of total transpiration take place through this route.**
- The cuticle present on the upper and lower epidermis of leaves is not completely impermeable to water and some water is lost in the form of vapours through cuticle.
- **The thinner the cuticle the greater rate of transpiration although the composition of cuticle is also important.**
- At night, when the stomata are almost closed, cuticular transpiration takes place. Most of the factors which affect rate of transpiration, in general, are also important in controlling the rate of cuticular transpiration.

(ii) Lenticular transpiration

- Lenticular transpiration is the loss of water vapours through lenticels present in the stem of some plants.
- **The lenticular transpiration is 1 – 2% of the transpiration by a plant.**
- Lenticels are aerating pores formed in the bark through which exchange of gases takes place, and water is lost in the form of water vapours (transpiration). Externally, they appear as scars or small protrusions on the surface of stem.
- Lenticel consists of a loose mass of small, thin – walled cells. At each lenticel the cork cambium forms oval, spherical, or irregular cells, which are very loosely arranged, having lots of intercellular spaces.

(iii) Stomatal transpiration:

- It is a type of transpiration in which the water vapours escape through stomata. In isobilateral leaves the stomata are present, in both, upper and lower epidermis e.g. lily and maize leaf. In dorsoventral leaves the stomata are confined to only the lower epidermis.
- The guard cells are normally dumble or bean – seed – shaped. The inner concave sides of two guard cells enclose the stoma. This inner side of guard cell has very thick cell wall, but the outer convex side has thin cell wall.
- The guard cells are the only cells, of leaf epidermis, which are not connected by plasmodesmata to other epidermal cells, and which have chloroplasts – and thus are involved in the process of photosynthesis.
- When these guard cells are turgid, the stoma between them opens and when the guard cells are flaccid the stoma between them closes.
- **The degree of opening of stomatal pores also affects the rate of transpiration. 90% of total transpiration in a plant is stomatal.**

Factors affecting the rate of transpiration

(i) Light
(ii) Temperature
(ii) CO2 concentration
(iv) Humidity and vapour pressure
(v) Wind and
(vi) Availability of soil water.

i) Light: The opening and closing of stomata is directly controlled by the light. In strong light the rate of transpiration is much more as compared with that in dim light or no light. As Potassium actively enters the guard cells, when light is available, water follows – and guard cells become turgid, and stoma opens.

ii) Temperature: When the sun – light is strong on a bright and sunny day the environmental temperature is increased. The higher temperature reduces the humidity of the surrounding air. The evaporation of water from the surfaces of mesophyll cell also increases, thus increasing the rate of transpiration.

The rate of transpiration doubles by every rise of 10° C in temperature. Very high environmental temperature, i.e.40-45°C cause closure of stomata, so that plant does not loose much needed water. If higher temperatures are maintained in the environment for a longer duration and soil water is limited, the plants would and my die.

iii) Carbon dioxide concentration: Low carbon dioxide concentration (such as those that occurs during the day when photosynthesis exceeds respiration), stimulates the active transport of Potassium ions into the guard cells. This transport causes stomata to open and allow CO_2 to diffuse in the mesophyll cells of leaves. At night cellular respiration in the absence of photosynthesis raises CO_2 levels. This halts the inward transport of K^+, and thus of water, allowing the guard cells to become flaccid and stomata close. Thus transpiration almost stops.

iv) Humidity and vapour pressure: When air is dry, the rate of diffusion of water molecules, from the surfaces of mesophyll cells, air spaces, and through stomata to outside the leaf, increases. So more water is lost, increasing the rate of transpiration. In humid air the diffusion rate is reduced. This decreases the rate of transpiration appreciably.

v) Wind: The air in motion is called wind, which causes increase in rate of diffusion of water molecules. The rate of evaporation from the surfaces of mesophyll cells increases. When air is still, the rate of movement of water molecules (diffusion) is slowed down, thus reducing the rate of transpiration.

vi) Availability of soil water: If there is little water in the soil, less is brought or transported to the leaf cells and less is lost to the environment by transpiration. So when the rate of absorption of water in root cells is reduced, the rate of transpiration is reduced.

Transpiration as a necessary evil

- Transpiration has been described as necessary evil because it is an inevitable, but potentially harmful consequence of the existence of wet cell surface from which evaporation occurs.
- Loss of water from the plant can lead to wilting, serious desiccation and often death of a plant if conditions of drought are experienced.
- There is good evidence that even mild water stress results in reduced growth rate and in crops to economic losses through reduction of yield.

i) Water is conducted or transported in most tall plants with the courtesy of transportation pull.

ii) Minerals dissolved in water are distributed throughout plant body by transpiration stream.

iii) Evaporation of water from the exposed surface of cells of leaves has cooling effect on plant.

iv)Wet surface of leaf cells allow gaseous exchange.

TRANSLOCATION OF ORGANIC SOLUTES

Phloem Transport

- The phloem is generally found on the outer side of both primary and secondary vascular tissue in plants with secondary growth. The phloem constitute the inner bark. The cells of phloem that conduct or transport sugars and other organic material throughout the plant are called sieve elements.
- In addition to sieve elements, phloem tissue also contains companion cells, parenchyma cells, and in some cases fibres, sclereids and latex containing cells. However, only sieve tube cells directly involved in transport of organic solutes.
- Each sieve tube member is associated with one or more companion cells. Sieve tubes and companion cells are in communication with each other by plasmodesmata.
- Companion cells supply ATP and proteins to sieve tubes. The photosynthetic products from photosynthesizing cells, the mesophyll and palisade layer of leaf, pass into sieve tubes, through the companion cell via plasmodesmata.

Patterns of Transport

✓ **Transport or translocation occurs from the areas of supply (sources) to areas of metabolism or storage (sinks).**

The areas of sources include any exporting organ typically a mature leaf, or storage organ, that is capable of
i) Storing photosynthate in excess of its own needs.
ii) Storage organ during the exporting phase of its development. In biennials e.g root of beet is a sink in first growing season, but becomes source in the next growing season, when sugars are utilized in growth of new shoots.
iii) Sinks are the areas of active metabolism or storage for example roots, tubers, developing fruits, immature leaves, and even the growing tips of stem and root.

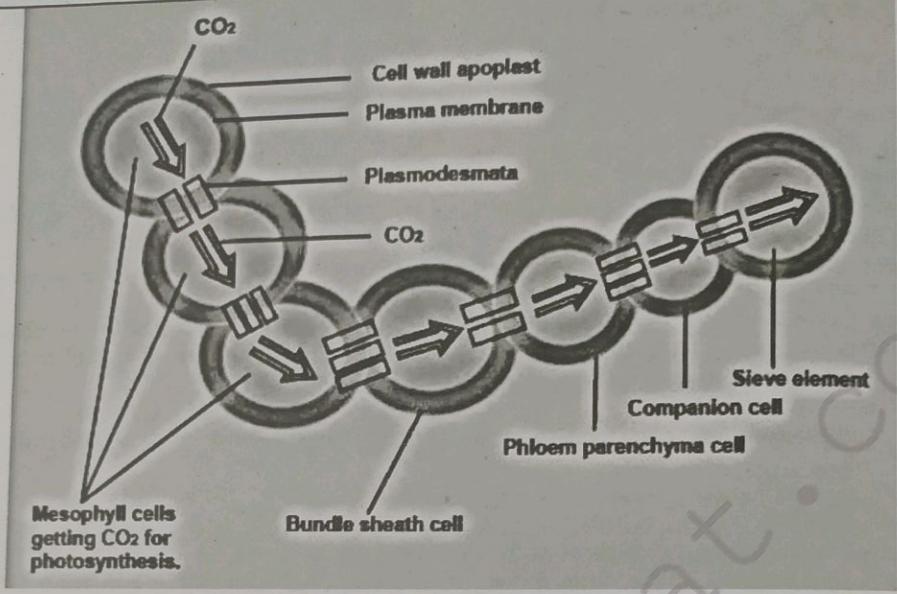
✓ **The composition of honey dew have revealed that it contains 10-25% dry matter 90% or more of which is sucrose. Nitrogenous compounds are about 1%.**

The Mechanism of phloem translocation/ transport

- The theory called, Pressure – Flow Theory, is the most acceptable theory for the transport in the phloem of angiosperms.
- There were two main categories of theories to account for movement of sap in phloem. The active theories involving the use of energy for the movement of materials in phloem, and the passive theories in which no use of energy was involved. The active theories have all been abandoned as there is not much evidence to support these theories.
- Now we are left with passive theories of transport / translocation. These include:

(i) **Diffusion** (ii) **Pressure flow theory**

(i) **Diffusion:** is far too slow, to account for the velocities of sugar movement in phloem, which on the average is **1 metre per hour**, while the rate of diffusion is **1 metre per eight years**. So we are left with pressure flow theory.



(ii) Pressure flow theory:A hypothesis was first proposed by Ernst Munch in 1930. It states that the flow of solution in the sieve elements is driven by anosmotically generated pressure gradient between source and sink.

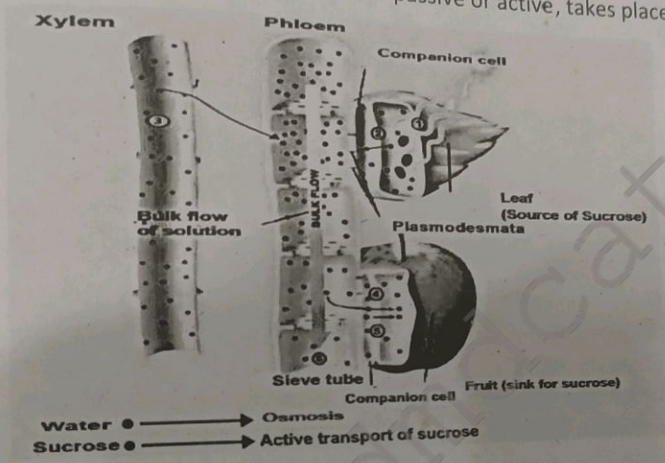
(1) The glucose formed in the photosynthesizing cells, is used within the cells (for respiration etc.) and the rest is converted into non – reducing sugar i.e. sucrose.

(2) This sucrose is actively transported through the bundle sheath cells to the companion cell of the smallest vein in leaf, a short distance transport (involving 2 – 3 cells). Thus sucrose diffuses through plasmodemata to sieve tube cell or sieve element, raising the concentration of sucrose in it.
The pathway taken by sucrose is symplast in most cases; but is some, apoplastic movement does take place. The sucrose is actively transported to the sieve elements.
(3) The water moves by osmosis from the nearby xylem in the leaf vein. This increases the hydrostatic pressure of the sieve tube element.
(4) Hydrostatic pressure moves the sucrose and other substances in the sieve tube cells, and moves to sinks e.g. fruits and roots.
In the storage sinks, such as sugar beet root and sugarcane stem, sucrose is removed into apoplast prior to entering symplast of the sink.
(5) Water moves out of sieve tube cell by osmosis, lowering the hydrostatic pressure.

- In symplastic pathway, sucrose (or sugars) move through plasmodesmata to the receiver cell. Thus according to pressure flow theory, the pressure gradient is established as a consequence of entry of sugars in the sieve elements at the source; and removal of sugars (sucrose) at the sink.
- The energy driven entry of sugars in sieve tube elements, generate high osmotic pressure in the sieve tube elements of the source causing a steep drop in the water potential.

(6) The presence of sieve plates greatly increases the resistance along the pathway and results in the generation and maintenance of a substantial pressure gradient in the sieve elements between source and sink.

- The sieve element's contents are physically pushed along the transportation pathway by bulk flow, much like water flowing through a garden hose.
- The pressure flow theory accounts for the mass flow of molecules within phloem.
- It may be noted that the transportation of photosynthetic or carbohydrates from the mesophyll cells to phloem tissue involves diffusion and active transport (carrier mediated transport). Then in phloem tissue (sieve tubes) the movement of materials is according to pressure flow theory.
- Again in the sink cells when the sugar and the carbohydrates are passed from the phloem tissue, diffusion and carrier mediated transport, either passive or active, takes place.



Xerophytes

- Have the adaptations for reduced rate of transpiration.
- Many xerophytes possess small, thick leaves to limit water loss by reducing surface area proportional to the volume.
- Their cuticle is thick, waxy and leathery.
- Stomata on lower surface of leaves and located in depression.
- Some as cacti, during the driest season shed their leaves to restrict transpiration completely, thus stems are the photosynthetic organs. In rainy season, stem stores water stores water for use in dry conditions.

MCQs OF TRANSPORT IN PLANTS

1. **Sap ascends in woody plants because of the root pressure and**
   A) Transpiration pull B) Capillarity C) Molecular adhesion D) Photosynthesis
2. **Xylem is associated with the translocation of**
   A) Water
   B) Some organic nitrogen and hormone
   C) Mineral
   D) All of these
3. **The most widely accepted explanation for the ascent of sap in tree is**
   A) Capillarity
   B) Roll of atmospheric pressure
   C) Pulsating action of living cells
   D) Transpiration cohesion theory of Dixon
4. **A column of water within xylem vessels of tall trees does not break under its weight because of:**
   A) Tensile strength of water
   B) Lignification of xylem vessels
   C) Positive root pressure
   D) Dissolved sugars in water
5. **Which of the following is incorrect about symplastic pathway?**
   A) Movement of water is relatively slower
   B) Movement is down the concentration gradient
   C) It may be aided by cytoplasmic streaming
   D) Most of the water flow in root occurs by this way
6. **Water vapour comes out from the plant leaf through the stomatal opening. Through the same stomatal opening carbon dioxide diffuses into the plant during photosynthesis. Reason out the above statements using one of following options:**
   A) Both processes cannot happen simultaneously
   B) Both processes can happen together because the diffusion coefficient of Water and CO_2 is different
   C) The above processes happen only during night time
   D) One process occurs during time and the other at night
7. **In a hot summer day, a plant cools itself due to**
   A) Loss of water vapours from leaf
   B) Transport of water in plant
   C) Loss of liquid water
   D) Loss of water from entire plant
8. **Which of the following is an adaptation to reduce water loss?**
   A) Presence of thick cuticle
   B) Change of leaf into phylloclade
   C) Change of leaf into spine
   D) All of these
9. **What is the means of transport through which sucrose moves into sieve tube of source and out of sieve tube at sink?**
   A) Simple diffusion
   B) Facilitated diffusion
   C) Active transport
   D) Passive transport
10. **When sugar is added to the source water potential of sucrose _____ and when sugar is removed from sink, the water potential of sink_____.**
    A) ↑es, ↑es B) ↑es, ↓es C) ↓es, ↓es D) ↓es, ↑es
11. **Select from the following (in numbers) the correct function which are performed by transpiration.**

(1) Creates transpiration pull for absorption and transport of water in plant.
(2) Transport minerals from the soil to all parts of the plant.
(3) Cools the leaf surface (sometime 10 – 15°C).
(4) Supplies water for photosynthesis.
(5) Maintains the shape and structure of plants by keeping the cells turgid.

A) 1 B) 3 C) 4 D) 5

12. **Which of the following is called necessary evil?**
A) Osmosis B) Transpiration C) Absorption D) Photosynthesis

13. **The rate of transpiration in plants is dependent upon**
A) Temperature and soil
B) Wind, temperature and light
C) Light and temperature
D) Light, temperature, atmospheric humidity and wind

14. **The force responsible for upward conduction of water against gravity comes from**
A) Transpiration B) Translocation C) Photosynthesis D) Respiration

15. **Translocation of organic materials is best explained by:**
A) Imbibition theory C) Active transport
B) Pressure flow hypothesis D) Transpiration pull

16. **Water will be absorbed by root hairs when**
A) Concentration of solutes in the cell sap is high
B) Plant is rapidly respiring
C) They are separated from soil by a permeable membrane
D) Concentration of salts in the soil is high

17. **The ultimate cause for the movement of water against gravity in a tree is**
A) Osmosis B) Transpiration C) Imbibition D) Photosynthesis

18. **The path of water from soil up to secondary xylem is**
A) Soil → Root hair cell wall → Cortex → Endodermis → Pericycle → Protoxylem → Metaxylem
B) Cortex → Root hair → Endodermis → Pericycle → Protoxylem → Metaxylem
C) Pericycle → Soil → Root hair → Cortex → Endodermis → Protoxylem → Metaxylem
D) Soil → Root hair cell wall → Cortex → Pericycle → Endodermis → Protoxylem → Metaxylem

19. **Osmosis is the movement of**
A) Solute particles from higher concentration to lower concentration
B) Solvent particles from higher water potential to lower water potential
C) Solute particles from higher concentration to lower concentration through a semipermeable membrane
D) Solvent particles from lower water potential to higher water potential

20. **Transpiration takes place when outer atmosphere has**
A) Percentage of moisture more than that of stomatal cavity
B) Percentage of moisture less than that of stomatal cavity
C) Percentage of moisture equal in atmosphere and stomatal cavity
D) High percentage of moisture

21. **Which of the following is NOT a function of transpiration?**
A) Excretion of minerals
B) Cooling of leaves
C) Uptake of water
D) Uptake of minerals

22. **Which of the following wall of guard cells is thick?**
A) Inner B) All the three C) Side wall D) Outer

23. **Stomata will open, if there is accumulation of the following element in the guard cells**
A) Magnesium B) Zinc C) Potassium D) Iron

24. **Which of the following contributes most to transport of water from the leaves of a tall tree?**
A) Break down of ATP
B) Cohesion of water and transpiration pull
C) Root pressure
D) Capillary rise of water in xylem

25. **In cactus, the main photosynthetic organ is?**
A) Stem B) Roots C) Leaves D) Homs

26. **Rate of transpiration in a dorsoventral leaf is**
A) Greater at the upper surface
B) Greater at the lower surface
C) Equal at both the surfaces
D) None of the above

27. **Stomata of a plant open due to**
A) Influx of potassium ions
B) Efflux of potassium ions
C) Influx of hydrogen ions
D) Influx of calcium ions

28. **A sudden increase in carbon dioxide concentration around a leaf will cause**
A) Decrease in transpiration due to closure of stomata
B) Wider opening of stomata
C) Increase in transpiration
D) Closure of stomata

29. **Which of the following changes in the cell sap of the guard cells is responsible for keeping the stomata open during day time?**
A) Decrease in osmotic pressure but increase in turgor pressure
B) Increase in osmotic pressure but decrease in turgor pressure
C) Increase of both osmotic and turgor pressure
D) Decrease of both osmotic and turgor pressure

30. **Which of the following maintains the shape of the cell?**
A) Osmotic pressure B) Wall pressure C) Turgor pressure D) Osmosis

31. **Stomatal pore has wider opening in**
A) Far red light B) Green light C) Blue light D) Yellow light

32. **At very high temperature a hormone abscisic acid is released by which one of the following cells?**
A) Guard cell B) Mesophyll cell C) Epidermal cell D) Xylem cell

33. **During symplastic pathway water moves through**
A) Cytoplasm B) Cell membrane C) Plasmodesmata D) All of these

34. **During plasmolysis**
A) Cell membrane of a plant cell shrinks away from its cell wall
B) Water first lost from the cytoplasm and then from the vacuoles
C) Area between cell wall and shrunken protoplast is occupied by outer solution

D) All the above

35. **Force generated by transpiration creates pressure sufficient to lift a xylem sized column of water over _____ meters.**

A) 130 B) 200 C) 400 D) 500

36. **Opening and closing of stomata is due to the:**

A) Gaseous exchange

B) Change in turgor pressure of guard cells

C) Hormonal change in guard cells

D) Respiration

37. **The translocation of organic solutes in sieve tube members is supported by**

A) P-proteins

B) Root pressure and transpiration pull

C) Cytoplasmic streaming

D) Mass flow involving a carrier and ATP

38. **With an increase in the turgidity of a cell, the wall pressure will:**

A) Increase

B) Fluctuate

C) Decrease

D) Remain unchanged

39. **Which of the following is the most accepted theory for movement of water through plants?**

A) Passive transport

B) Pressure Flow Theory

C) Cohesion theory

D) Root pressure

40. **The plants with thick cuticle, small needle like leaves and sunken stomata belongs to**

A) Mesophytes

B) Halophytes

C) Hydrophytes

D) Xerophytes

Answers:

1.	A	2.	D	3.	D	4.	A	5.	D	6.	B	7.	A	8.	D	9.	C	10.	D
11.	D	12.	B	13.	D	14.	A	15.	B	16.	A	17.	B	18.	A	19.	B	20.	B
21.	A	22.	A	23.	C	24.	B	25.	A	26.	B	27.	A	28.	A	29.	C	30.	C
31	C	32	B	33	D	34	D	35	B	36	B	37	D	38	A	39	C	40	D

CHAPTER 07

TRANSPORT IN HUMAN

COURSE CONTENT

- Heart: Structure of heat, Cardiac Cycle, Control of Heart Beat, ECG and Blood Pressure
- Blood Vessels: Arteries, Veins and Capillaries
- Blood: Plasma and Blood Cells (RBCs, WBCs and platelets).
- Lymphatic System

COURSE CONTENT
- Heart: Structure of heat, Cardiac Cycle, Control of Heart Beat, ECG and Blood Pressure
- Blood Vessels: Arteries, Veins and Capillaries
- Blood: Plasma and Blood Cells (RBCs, WBCs and platelets).
- Lymphatic System

BLOOD

- The weight of blood in our body in about $1/12^{th}$ of our body.
- The normal ***pH*** of blood is 7.35-7.45
- It is made up of two main components i.e. plasma and cells or cell like bodies.

PLASMA

- Inorganic ions and salts make up 0.9% of the plasma by weight. More than 2/3 of this amount is sodium chloride.
- Most of the plasma proteins are synthesized in liver. Some of the globulins (immunoglobulins) are produced by lymphocytes and released in plasma or lymph in response to antigen.
- **Thrombin** acts as a catalyst in blood clotting process.
- **Fibrinogen** takes part in blood clotting process.
- **Immunoglobulins** play important role in body's defense against disease.
- Organic nutrients include glucose, fats, phospholipids, amino acids and lactic acid.
- Some of them enter blood from intestine (absorption).
- **Lactic acid** is produced in muscles as a result of glycolysis and is transported by blood to liver.
- **Cholesterol** is either metabolized or used as precursor of steroid hormones.
- Nitrogenous wastes are produced as a result of cellular metabolism. These products are carried from the liver where they are produced, to the organs from where they are removed i.e. kidneys. Urea and small amounts of uric acid are present in plasma.
- Hormones and gases are also found in plasma.

TYPES OF BLOOD CELLS

FEATURE	RBCs	WBCs	PLATELETS
Name	Erythrocytes	Leucocytes	Thrombocytes
Colour	Red	Colourless	Colourless
Formation	Liver & spleen (embryonic life), red bone marrow of sternum, ribs, vertebrae (adult life)	Red bone marrow &lymphatic system	Red bone marrow
Size	8µm	Larger than RBC	Small than RBC
Shape	Biconcave	Polymorphic	Plate like
Number per mm^3 of blood	5-5.5 million (male), 4-4.5 million (female)	7000-8000	250,000 – 300,000
Structure	Elastic cell membrane, no nucleus, 95% Hb, 5% enzymes, salts, proteins	Nucleus is Present	No nucleus, membrane bounded Cytoplasmic fragments of cells
Life span	4 months (120 days)	Variable	-
Function	Transport of gases	Immunity	Blood clotting

Types of WBC

Feature	Neutrophils	Eosinophils	Basophils	Monocytes	Lymphocytes
Size in relation of RBC	Twice	Twice	Twice	Twice to thrice	Slightly larger
Nucleus	2-5 lobed	Bilobed	Bilobed	Round to lobed	Round, nearly filling cell
%age	62%	2%	1%	3%	32%
Function	Destruction of small particles by phagocytosis	Inactivate inflammation producing substances & attack parasites	Release heparin to prevent blood clots & histamine to cause inflammation	Destroy large particles by phagocytosis, form tissue macrophages 10-20 hrs after production	Immune response producing antibodies

HEART

- The human heart is located in the chest cavity.
- The heart is enclosed in a double membrane sac- the pericardial cavity, which contains the pericardial fluid.
- Pericardium protects are heart, prevents it from over extension.
- The wall of the heart is composed of three layers: Epicardium, Myocardium and endocardium.

There are four chambers of heart: two upper thin walled atria and two lower thick walled ventricles.

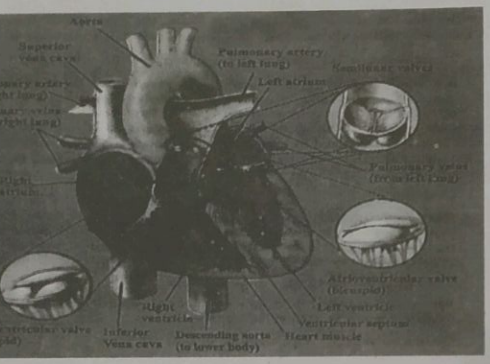
Tricuspid (3 flaps) valve is present between right atrium and right ventricle.

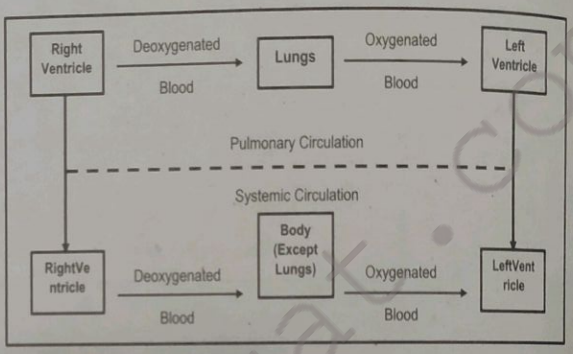
Bicuspid valve (2 flaps) is present between left atrium and left ventricle.

These flaps are attached with fibrous cords called chordeae tendinae, to the papillary muscles.

Semilunar valves are present at base of aorta and pulmonary trunk.

The wall of left ventricle is thicker (3 times) than that of right ventricle.





HE CARDIAC CYCLE

Heart beat involves three distinct stages i.e. atrial systole, ventricular systole and diastole.

Relaxed period of heart chambers is called ***diastole***. During this period, atria have more pressure than the ventricles.

One complete ***heartbeat*** consists of one systole and one diastole and lasts for about 0.8 seconds. In one's life heart contracts about 2.5 billion times, without stopping.

MECHANISM OF HEARTS EXCITATION AND CONTRACTION

Heartbeat starts when the sino-atrial node **(pacemaker at the upper end of right atrium)** sends out electrical impulses to the atrial muscles, thus causing both atria to contract.

The **sino – atrialnode** consists of small number of diffusely oriented cardiac fibres, possessing few myofibrils and few nerve endings from the autonomic nervous system..

Impulses from the SA node travel to the musculature of the atrium and to atrioventricular node (AV).

There is a delay of approximately 0.15 seconds in conductance from the S-A node to A-V node, permitting atrial systole to be completed before ventricular systole begins.

Pacemaker is responsible for initiating the impulses, which trigger the heartbeat rate.

LECTROCARDIOGRAM

As the cardiac impulses passes through heart, electrical currents spread into tissues surrounding the heart.

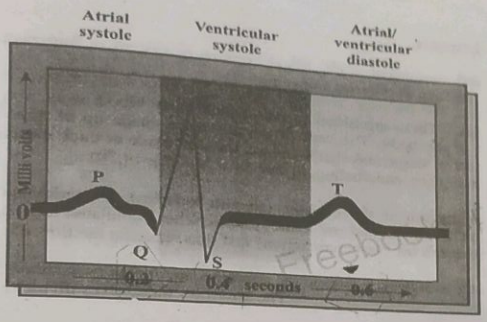
Electrodes are placed on the skin on opposite sides of the heart, electrical potentials generated by these currents can be recorded.

This recording is known as **electrocardiogram** which is taken by ECG machine.

It helps to diagnose the abnormalities in the rhythmicity and conduction system of the heart.

In an ECG:

- **P wave** represents atrial contraction.
- **QRS complex** represents ventricular contraction.
- **T wave** represents ventricular relaxation.



Blood Vessels

- Blood vessels are involved in the transportation of circulatory fluid (blood). They are three types of blood vessels i.e. Arteries, Veins and Capillaries

Feature	Arteries	Veins	Capillaries
Direction of Blood Flow	They transport blood away from heart to various parts of body	They collect blood from various parts of body and transport it towards heart	They link arteries with veins
Type of Blood	All carry oxygenated blood except pulmonary arteries	All carry deoxygenated blood except pulmonary veins	They have mixed blood
Structure	• Three layers • Outer: Connective tissue and Elastic fibers • Middle: Circular smooth muscles and Elastic fibers • Inner: Endothelium	• Three layers • Outer: Connective Tissue • Middle: Circular smooth muscles and thin elastic membrane • Inner: Endothelium	Only one cell thick endothelium
Elasticity	• Elastic	• Less elastic	Inelastic
Pulse	Pulse due to heartbeat detected	No pulse	No pulse
Valves	No valves except at the base of aorta	Semilunar valves present to prevent the backflow of blood	No valves
Blood Pressure	High blood pressure	Low blood pressure	Falling pressure in these
Rate of Blood Flow	Rapid blood flow 400-500 mm/sec	Increases from smaller to larger veins	Blood flow is slowest 1mm/sec
Exchange of Material	No exchange of materials	No exchange of materials	Exchange of materials

Bore & Thickness	Have smaller bore and thick walls	Have larger bore and thin walls	Larger bore; wall one cell in thickness

✓ **BLOOD PRESSURE**

- It is the measure of force with which blood pushes up per unit area against the walls of blood vessels.
- It is the force that keeps blood flowing from the heart to all the capillary networks in the body.
- The blood pressure is generated by the contraction of ventricles. This is called **systolic pressure.**
- The blood pressure is generated by the contraction of ventricles. This is called diastolic pressure.
- When the ventricles relax, the atrial pressure is lowest and is called diastolic pressure.
- The normal systolic blood pressure is **120 mm Hg** which is during ventricular systole.
- The normal diastolic blood pressure is **75-85 mm** Hg which is during diastole of the heart

✓ **BLOOD VESSELS AND HEART DISORDERS**

- **Atheroma** is the deposition of hard yellow plaque of lipoid material in the inner most layer of arteries which may be due to the high level of cholesterol in the blood.
- **Arteriosclerosis** is a degenerative arterial change associated with advancing age and it is a thickening of the middle layers of arteries and is associated with some sort of atheroma.
- **Atherosclerosis** causes narrowing and hardening of arteries and increases the risk of thrombus formation which can be fatal if occurs in brain and heart.
- **Atherosclerosis** is a major condition leading to heart attack.

DISORDERS	DEFINITION	CAUSE/RISK FACTORS	EFFECTS
Thrombosis	▪ Thrombus is a solid mass or plug of blood clot in a blood vessel and can completely or partially block blood vessel.	▪ Irritation or infection of lining of blood vessels. ▪ Reduced rate of blood flow. ▪ Pneumonia and tuberculosis, emphysema	▪ Cerebral infarction or myocardial infarction.
Embolism	▪ When thrombus is dislodged to other location in circulatory system it is called as embolus	▪ Hypertension ▪ Atherosclerosis ▪ High blood cholesterol ▪ Thrombus	▪ Blockage of artery. ▪ Cerebral infarction or myocardial infarction.
Myocardial Infarction	▪ Necrosis or damage to the portion of heart muscles, a condition known an myocardial infarction	▪ Thrombus, embolus, atheroma. ▪ Fatty food (cholesterol rich) ▪ Obesity ▪ Hypertension ▪ Smoking	▪ Sharp pain in the chest ▪ Pain in the jaw and upper arm ▪ Sweating ▪ Arrhythmias & ventricular fibrillation
Cerebral Infarction	▪ Blockage or narrowing of arteries supplying blood and oxygen to the brain	▪ Thrombus, embolus, atheroma. ▪ Fatty food (cholesterol	▪ Symptoms depend on the part of brain affected.

	can cause necrosis and damage, a condition called cerebral infarction	rich) ▪ Obesity ▪ Hypertension ▪ Smoking	

Lymphatic System

- This system is involved in **transport and returning of material** from the tissues of the body to the blood.
- It **comprises of** lymph capillaries, lymph vessels, lymphoid masses, lymph nodes, and lymph.
- **Lymph** is the fluid which flows in the system.
- The **lymph vessels** empty in veins; lymph is a fluid in transit between interstitial fluid and the blood. The **intercellular spaces** in the walls of lymph vessels are larger than those of the capillaries of blood vascular system.
- **Lacteals** are the branches of lymph capillaries inside villi of intestine.
- **Lymph capillaries** are blind ended structures.
- Masses of connective tissue where lymphocytes are present are called **lymph nodes.**
- Lymph nodes are present in neck region, axilla and groin of humans.
- Several afferent lymph vessels enter a lymph node, which is drained by single efferent lymph vessel.
- The flow of lymph is maintained by:
  - (i) **Activity of skeletal muscles**
  - (ii) **Movement of viscera**
  - (iii) **Breathing movements**
  - (iv) **Semilunar valves that prevent backward flow Functions**

✓ Return of excess extracellular fluid and proteins to the blood.

✓ Absorption of large fat globules by lacteals of villi. After a fatty meal these fat globules may make up 1 % of the lymph.

✓ Play important role in the defense system of the body.

✓ Just as the lymph nodes filter lymph, the spleen filters blood, exposing it to macrophages and lymphocytes that destroy foreign particles and aged red blood cells.

MCQs OF TRANSPORT IN HUMAN

1. Haemoglobin makes _____ of R.B.C. dry contents:
   A) 95% B) 35% C) 50% D) 70%
2. How many Haem groups are present in one molecule of Hb?
   A) 4 B) 3 C) 2 D) 1
3. Inorganic ions and salts make up percent of plasma:
   A) 55% B) 5 – 7 % C) 45% D) 0.9%
4. Which of the followings is involved in protective mechanisms:
   A) Lymphocytes B) Monocytes C) Phagocytes D) All of these
5. The thalassaemia is also called:
   A) Blood cancer B) Leuceaemia C) Cooley's anemia D) Oedema
6. Which can serve as precursor of steroid hormone:
   A) Lactic acid B) Cholesterol C) Phospholipids D) Glucose
7. All of following are included in granulocytes except:
   A) Neutrophills B) Eosinophill C) Basophils D) Monocytes
8. Uncontrolled production of WBCs is called:
   A) Thalassaemia B) Leucaemia C) Oedema D) Leucopenia
9. The weight of blood in our body is about _____ of our body:
   A) ¼ B) 1/10 C) 1/12 D) 1/16
10. Heart receives its nerve supply from which types of nervous system:
    A) Sympathetic B) Parasympathetic C) Both of these D) Paratonic
11. Right atrium receives blood from:
    A) Superior vena cava B) Inferior vena cava C) Both D) None
12. Systolic pressure in normal individuals is:
    A) 60mm of Hg B) 120mm Hg C) 30mm of Hg D) 80mm of Hg
13. Lymph closely resemble with:
    A) Blood B) Plasma C) Interstitial fluid D) Urine
14. Which may be the most common cause of atherosclerosis:
    A) High blood pressure
    B) High Ca^{++} level
    C) High cholesterol level
    D) All of these
15. Where the lymph nodes are present in more concentration:
    A) Axilla B) Groin C) Forearm D) A & B
16. Fat globules are absorbed by lacteals and after a fatty meal these fat globules make up lymph in percent:
    A) 1% B) 10% C) 20% D) 5%
17. The heart beat cycle starts when electrical impulses are generated from?
    A) AV node B) SV node C) SA node D) PQ node
18. One complete heart beat consists of one systole and one diastole and lasts for about?
    A) 0.8 sec B) 0.4 sec C) 0.2 sec D) 0.5 sec
19. Percentage of cell and cell like bodies in blood is
    A) 55% B) 58% C) 45% D) 35%
20. Agranulocytesareformed in?
    A) Thymus B) Adenoid C) Tonsils D) All of these
21. The valves at the base of veins are called:

A) Sphincters B) Semilunar C) Bicuspid D) Tricuspid

22. **Pick up the correct sequence of tissues found in the wall of artery:**
A) Connective tissue → circular smooth muscles → elastic layer → endothelium
B) Connective tissue → elastic layer → endothelium → circular smooth muscles
C) Connective tissue → endothelium → elastic layer → circular smooth muscles
D) Circular smooth muscles → connective tissue → endothelium → elastic layer

23. **'Bundle of His' is a part of which one of the following organs in humans?**
A) Kidney B) Brain C) Pancreas D) Heart

24. **Which one of the following plasma proteins is involved in the coagulation of blood?**
A) A globulin B) An albumin C) Fibrinogen D) Serum amylase

25. **The role of pacemaker in heart is to:**
A) Accelerate blood circulation
B) Inhibit backflow of blood
C) Initiate heart beat
D) Stimulate blood pressure

26. **Lack of pulmonary surfactant produces:**
A) Asthma
B) Emphysema
C) Cystic fibrosis
D) Respiratory distress syndrome

27. **Antibodies are a product of:**
A) Granulocytes B) Neutrophils C) Lymphocytes D) Monocytes

28. **In a normally healthy adult man, the systolic and diastolic blood pressures are:**
A) 120 and 80 mm Hg
B) 80 and 120 mm Hg
C) 70 and 120 mm Hg
D) 50 and 50 mm Hg

29. **The opening between the right atrium and the right ventricle is guarded by the value named:**
A) Bicuspid valve B) Mitral valve C) Tricuspid valve D) Semilunar valve

30. **Which one is correct regarding electrocardiograph (ECG)?**
A) P-wave represents the electrical excitation of the ventricle
B) QRS complex represents repolarization of the ventricles
C) T-wave represents repolarization of the atria
D) By counting the number of QRS complexes one can determine the pulse rate

31. **In which one of the following pairs the two items mean one and the same thing?**
A) Malleus–anvil
B) SA node pacemaker
C) Leucocytes–lymphocytes
D) Haemophilia–blood cancer

32. **The component of blood which prevents its coagulation in the blood vessels is:**
A) Haemoglobin B) Thrombin C) Plasma D) Heparin

33. **Thickening of arteries due deposition is:**
A) Arteriosclerosis B) Blood pressure C) Rheumatic heart D) Cardiac arrest

34. **Papillary muscles are found in:**
A) Pylorus in vertebrate stomach
B) Dermis of mammalian skin
C) Eye orbit of mammals
D) Ventricle in mammalian heart

35. **Blood circulation that stars in capillaries and ends in capillaries is called:**
A) Hepatic circulation
B) Portal circulation
C) Lymphatic circulation
D) Renal circulation

36. **NaCl constitutes about _____% of plasma solutes:**
A) 0.9% B) 0.6% C) 2 – 3% D) 0.1%

37. **If the heart sound recording and the ECG recordings were superimposed then the first heart sound would occur at:**

A) At the P wave
B) Just after the P wave
C) Just before the QRS complex
D) Just after the QRS complex

38. The important function of lymph is to:
A) Transport oxygen to the brain
B) Transport carbon dioxide to the lungs
C) Return RBCs to the lymph nodes
D) Return interstitial fluid to the blood

39. Chordae tendinae are found in:
A) Ventricles of brain B) Joints of legs C) Ventricles of heart D) Atria of heart

40. Which of the following chambers of the heart has the thickest muscular wall?
A) Left atrium B) Right ventricle C) Right atrium D) Left ventricle

Answers:

1.	A	2.	B	3.	D	4.	D	5.	C	6.	B	7.	D	8.	B	9.	C	10.	C
11.	C	12.	D	13.	C	14.	C	15.	D	16.	A	17.	C	18.	A	19.	C	20.	D
21.	B	22.	A	23.	D	24.	C	25.	C	26.	D	27.	C	28.	A	29.	C	30.	D
31	B	32	D	33	A	34	D	35	B	36	B	37	C	38	D	39	C	40	D

ASSESS YOURSELF

(TRANSPORT IN HUMAN)

1. **Water constitutes _____ percent of blood plasma:**
   A) 70 B) 80 C) 90 D) 100
2. **In the intestine, the branches of lymph capillaries, within villi are called:**
   A) Lymph vessels B) Lymphatic ducts C) Microvilli D) Lacteals
3. **Lymph node is drained by:**
   A) Many efferent lymph vessels C) Single efferent lymph vessels
   B) Many afferent lymph vessels D) Single afferent lymph vessels
4. **Just as the lymph nodes filter lymph, the _____ filters blood:**
   A) Liver B) Bone marrow C) Glomerulus D) Spleen
5. **It protects the heart and prevents it from over extension:**
   A) Pericardial fluid B) Ribcage C) Pericardium D) Thorax
6. **Human heart is responsible for:**
   A) Pulmonary circulation C) Systemic circulation
   B) Pulmonary and systemic circulation D) Lymphatic circulation
7. **Monocytes stay from _____ hours in the blood:**
   A) 10 – 20 B) 5 – 10 C) 15 – 20 D) 20 – 30
8. **In the embryonic life new erythrocytes are formed in the:**
   A) Red bone marrow B) Liver C) Spleen D) Liver and spleen
9. **The contraction of the circular smooth muscles of arteries and arterioles in under the control of:**
   A) Nervous system C) Nervous and Endocrine system
   B) Endocrine system D) Voluntary system
10. **Deposition of hard yellow plaque of lipoid material in the innermost layer of the arteries is called:**
    A) Atheroma B) Embolus C) Thrombus D) Sclerosis
11. **The heart beat cycle starts when the sino – atrial node at the upper end of right atrium sends out electrical impulses to the:**
    A) Ventricular muscles C) Atrioventricular muscles
    B) Atrial muscles D) Pericardial muscles
12. **Following are the lymphoid masses; except:**
    A) Thymus B) Tonsils C) Spleen and adenoid D) Liver and pancreas
13. **After a fatty meal the fat globules may make up:**
    A) 1% of the lymph B) 2% of the lymph C) 3% of the lymph D) 4% of the lymph
14. **Necrosis or damage to portion of heart muscles is consequence of:**
    A) Embolism C) Cerebral infraction
    B) Myocardial infarction D) Arythmia
15. **Heart attack is due to disruptions of control system of the heart with accompanying specially:**
    A) Arrythmias C) Atrial fibrillation
    B) Ventricular fibrillation D) Fibrillation of Aorta
16. **Worn out RBC are broken down and disintegrates partly by a process called:**
    A) Phagocytosis B) Hemolysis C) Erythroblastosis D) Hydrolysis
17. **There is a delay of approximately _____ second in conductance from S. A node to A-V node:**
    A) 0.8 B) 0.15 C) 2.5 D) 0.3
18. **The force that keeps the blood flowing from the heart to all the capillary network in the body is called:**

A) Blood pressure B) Atrial systole C) Atrial diastole D) Ventricular diastole

19. The highest blood pressure in human being is found in:

A) Venae cavae B) Aorta C) Pulmonary trunk D) Arterioles

20. Pressure in the arteries fall during:

A) Systole B) Diastole C) Relaxation of atria D) Contraction of ventricles

21. Diastolic pressure of normal individuals ranges from:

A) 115 – 120 mm Hg B) 110 – 120 mm Hg C) 75 – 85 mm Hg D) 70 – 80 mm Hg

22. 95% of the cytoplasm of red blood cells is the:

A) Antibodies B) Enzymes C) Haemoglobin D) Proteins

23. _____ give rise to macrophages, which destroy larger particles by phagocytosis.

A) Nautrophils B) Monocyte C) Basophila D) Lymphocyte

24. Which of the following are proteins in nature?

A) Antibodies. B) Antitoxins C) Interferons D) All of these

25. All of the following are blood clots except:

A) Thrombus B) Atheroma C) Embolus D) Hematoma

26. The flow of lymph is maintained by:

A) Movement of viscera C) Breathing movements

B) Valves D) All of these

27. Blood cells which attack parasites and inactivates inflammation producing substances are

A) White blood cells B) Eosinophils C) Basophils D) Lymphocytes

28. Which of the following is/are functions of lymphatic system?

A) Return of excess fluid C) Fats absorption

B) Immunity D) All A,B,C

29. **Which of the following is incorrect about erythrocytes?**

A) Once mature do not divide

B) Biconvex and have elastic plasma membrane

C) Formed in red bone marrow

D) These are a nucleated cells

30. **The pressure within capillaries causes a continuous leakage of fluid from the blood plasma into the spaces that surround the capillaries and tissue. This fluid is known as:**

A) Lymph B) Intracellular Fluid C) Interstitial fluid D) Serum

31. **Smallest white blood cells are:**

A) Neutrophils B) Eosinophil C) lymphocytes D) monocytes

32. Main proteins involved in maintaining colloid osmotic pressure of blood are:

A) Albumin B) Globulins C) Fibrinogen D) Prothrombin

33. Inferior vena cava receives blood from all of the following except:

A) Iliac veins B) Renal veins C) Hepatic portal veins D) Hepatic veins

34. Outlet valves of heart are called:

A) Tricuspid valve B) Semi lunar valve C) Bicuspid valve D) Mitral valve

35. Which is correct about blood pressure in vessels?

A) Aorta > vena cava > veins > arteries C) Aorta > arteries > arterioles > capillaries

B) Vena cava > veins > aorta > capillaries D) Capillaries > aorta > arteries > venules

36. Choose the correct one:

Phase	ECG presentation	Tim

A)	Atrial systole	QRS complex	0.4 sec
B)	Ventricular systole	P wave	0.2 sec
C)	Atrial diastole	T wave	0.6 sec
D)	Ventricular diastole	QRS complex	0.8 sec

37. P wave shows

A) Conduction starts from AV node
B) Conduction in purkinje fibers
C) Conduction of impulse from SA node
D) Conduction of impulse on all ventricles

38. Elastic fibers and muscles are absent in?

A) Arteries
B) Capillaries
C) Veins
D) Present in all

39. For CO_2 which of the following is correct?

A) Capillary .....>cells .....>extracellular fluid
B) Cells .....> capillary .....>extracellular fluid
C) Cells .....> extracellular fluid .....> capillary
D) Extracellular fluid .....>cells .....>capillary

40. The flow of lymph is always

A) Towards thoracic duct
B) Away from the thoracic duct
C) Towards adenoids
D) towards axilla

CHAPTER 08

IMMUNITY

COURSE CONTENT

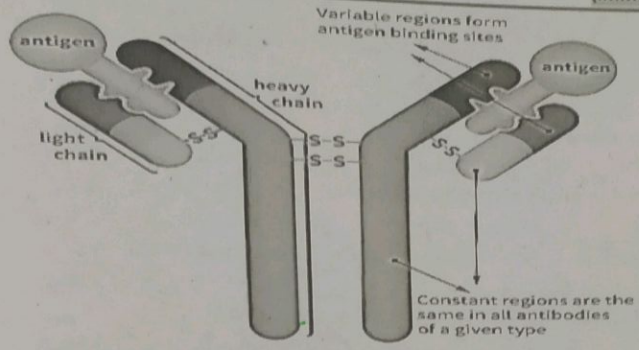
- Immune System and its Components
- Types of Immunity
- Vaccination

IMMUNITY

- The capacity to recognize the intrusion of any material foreign to the body and to mobilize cells and cell products to help remove the particular sort of foreign material with great speed and effectiveness is called **immunity.**
- Skin, mucous membrane and blood clot are physical barriers.

IMMUNE SYSTEM

- It has two main components i.e. lymphocytes and antibodies.
- **Antigen** or immunogen is a foreign substance, often a protein which stimulates the formation of antibodies.
- There are two major types of **lymphocytes** i.e. B & T lymphocytes.
- **T lymphocytes** have been given name due to their relationship with thymus glands. Thymus has role in maturation of T lymphocytes.The newly forming T cells migrate to thymus gland for processing.
- **B lymphocytes** have been given name due to their first discovery from bursa of fabricius, which is a lymphoid tissue in birds around cloaca. In humans, these are produced and released in mature form from bone marrow.
- **Antibodies / Immunoglobulins** are globular proteins, manufactured by B-lymphocytes, then secreted into the lymph and blood where they circulate freely. .
- Each antibody consists of four polypeptide chains; two heavy chains and two light chains.
- Each chain has a constant region and variable region. These are Y shaped molecules.



- There are two types of **immune responses**i.e. cell-mediated response and humoral immune response.
- T-cells recognize antigen and then combat microorganisms and / or effect the rejection of foreign tissue (in case of tissue transplant). This is called **cell mediated response.**
- B-cells recognize antigen and form plasma cell clone. These plasma cells synthesize and liberate antibodies into the blood plasma and tissue fluid. Here antibodies attach to the surfaces of bacteria and speed up their phagocytosis or combine with and neutralize toxins produced by micro-organisms, by producing antitoxins. This is called **humoral immune response.**

TYPES OF IMMUNITY

FEATURE	ACTIVE IMMUNITY	PASSIVE IMMUNITY
Production of Immunity	Produced because of antigen.	Produced because of antibodies.
Source of Antibodies	Body is stimulated to produce antibodies.	Antibodies are introduced from other source.
Substance entering	Antigen	Antiserum
Response	Delayed immune response	Immediate immune response
Memory cell production	Yes	No
Role	Preventive	Preventive and Curable

- When a person is exposed to an infection (antigen) becomes ill and in most cases survives, then this immunity developed against that disease is called **naturally induced active immunity.**
- The use of vaccines, which stimulates the production of antibodies in the body, and making a person immune against the diseases or infection, is called **artificial active immunity.** The process is called vaccination. This active immunity has been achieved by artificially introducing antigens in the body.
- **In natural passive immunity, If** the source of antibodies is natural then this type of immunity will be called as natural passive immunity.
- **In artificial passive immunity**, Antibodies which have been formed in one individual are extracted and then injected into the blood of another individual.
- **For example** snakebite, passive immunity is produced by antitoxins, so the serum is called antivenom serum.
- Similarly, specific antibodies used for combating tetanus and diphtheria are synthesized and injected in humans.

MCQs Of IMMUNITY

1. **Which one is a protective mechanism:**
   A) Coughing B) Sneezing C) Pyrexia D) All of these
2. **Cell mediated response is due to:**
   A) T-lymphocytes B) B-lymphocytes C) Monocytes D) Neutrophils
3. **Which stimulates the production of antibodies:**
   A) T-lymphocytes B) B-lymphocytes C) Both of these D) Antigens
4. **How many polypeptide chains contribute in the formation of antibody:**
   A) Two B) Four C) Three D) One
5. **How many disulfide bonds stabilize the antibody structure:**
   A) Two B) Four C) Six D) Eight
6. **Which of following is included in physical barriers:**
   A) Skin C) Both of these
   B) Mucous membrane D) None of these
7. **The serum containing antibodies is called:**
   A) Immune serum C) Hypersensitive serum
   B) Antiserum D) Multiserum
8. **The vaccines are referred to as produce:**
   A) Passive immunity B) Active immunity C) Both of these D) None of these
9. **The injection of antiserum in the body result in:**
   A) Active immunity B) Passive immunity C) Life time immunity D) Both B & C
10. **Which of followings is most likely destroyed by phagocytes:**
    A) Antigens C) Antigen antibody complex
    B) Antibodies D) All of these
11. **The third mechanism which defend the animal bodies against the foreign invaders is:**
    A) Antisepsis B) Immunization C) Phagocytosis D) Sweating
12. **Pick up the one which is not included in the functions of antibodies:**
    A) Immobilization of antigens
    B) Setting in motion events that ultimately cause the destruction of antigen
    C) Production of antitoxins
    D) Production of toxins
13. **T lymphocytes recognize antigen and attack microorganisms or transplanted organ and tissues. This effect is called**
    A) Cell-mediated response C) Active immunity
    B) Humoral immune response D) Passive immunity
14. **B – Lymphocytes originate from:**
    A) Lymphoid stem cells of bone marrow C) Lymphoid stem cells of thymus
    B) Bursa of fabricus D) Phagocyte stem cells
15. **Each antigen binding site of antibody consists of:**
    A) V – sequences of heavy chains
    B) V – sequences of light chains
    C) V – sequences of heavy chains and a light chain
    D) C – sequences of both heavy chains
16. **In case of tissue/organ transplant, the main threat of rejection is posed by:**

A) B – cells B) T – cells C) Antibodies D) Immunoglobulins

17. **The survivor of an infection mostly develops:**
A) Antiracial active immunity
B) Natural active immunity
C) Antiracial passive immunity
D) Natural passive immunity

18. **Plasma cells synthesis and liberate _____ in blood**
A) Antigen B) Immunogen C) Antibody D) Both a & c

19. **Hummoral immune response does not contain**
A) Antibodies B) B-lymphocytes C) Plasma cell clone D) T-lymphocytes

20. **In active immunization _____ is introduced into the body:**
A) Antigens B) Antibodies C) Immunoglobulins D) Antibiotics

21. **Passive immune response is:**
A) Long lasting B) Delayed C) Immediate D) Persistent

22. **Antibodies consists of:**
A) 2 light chains and 2 heavy chains arranged in a Y-shaped configuration
B) A light chain and 2 heavy chains arranged in a Y-shaped configuration
C) 2 light chains and a heavy chain arranged in a Y-shaped configuration
D) all of these

23. **Pick up the one that is active infection:**
A) Polio B) Mumps C) Rabies D) Small pox

24. **An infant getting immunity through mother's feed is an example of:**
A) Artificial active immunity
B) Artificial passive immunity
C) Natural active immunity
D) Natural passive immunity

25. **Pathogens are tagged to be phagocytized by:**
A) Antibodies B) Antigens C) Immunogens D) Foreign substances

26. **Vaccination was re-introduced with wider usage by:**
A) Edward Jenner B) Louis Pasteur C) Robert Koch D) Phipps

27. **A lymphoid structure present in the wall of cloaca of young birds is called:**
A) Thymus gland B) Bursa of fabricius C) Adenoid D) Spleen

28. **An immunity obtained by the inoculation of attenuated germs of that disease is called:**
A) Artificial active immunity
B) Natural active immunity
C) Artificial passive immunity
D) Natural passive immunity

29. **The hypothesis that the person who contracts cowpox does not subsequently contract small pox was made and tested by:**
A) James Phipps B) Edward Jenner C) Louis Pasteur D) Robert Koch

30. **The total number of disulphide bonds used to maintain the structure of an antibody molecule is:**
A) Two B) Three C) Four D) Five

31. **Thymus gland is involved in maturation of**
A) Platelets B) B-Lymphocytes C) Eosinophils D) T-Lymphocytes

32. **Immunity is:**
A) Ability to resist organism which tend to damage the tissues
B) Ability to resist toxins which tend to damage the tissues
C) Ability of skin to prevent any invasion of pathogens
D) Both (a) and (b)

33. **In passive immunity which of the following component are injected into blood:**
A) Antigens B) Immunogens C) Serum D) Immunoglobulins

34. **Which of the following Ig is involved in mediating allergic reactions?**
A) IgG B) IgM C) IgE D) IgA

35. **HIV attacks:**
A) T helper cells B) T cytotoxic cells C) B cells D) Macrophages

36. **Mucous membranes are part of body defense system and they offer**
A) Physical Barriers
B) Mechanical Barriers
C) Chemical Barriers
D) Biological Barriers

37. **Immediate protection is obtained from:**
A) Passive Immunity B) Active Immunity C) Vaccination D) Natural Activity Immunity

38. **Its victim often succumbs to a bacterial disease or cancer, that under normal circumstances, the immune system can overcome:**
A) Polio B) AIDS C) Rabies D) Tetanus

39. **T lymphocytes become mature and competent under the influence of**
A) Liver B) Bursa of fabricius C) Thymus gland D) Spleen

40. **Skin and mucous membranes are part of the body defense system and they form the**
A) Physical barrier
B) Mechanical barriers
C) Chemical barriers
D) Biological barriers

Answers:

1.	D	2.	A	3.	D	4.	B	5.	B	6.	C	7.	B	8.	B	9.	B	10.	C
11.	B	12.	D	13.	B	14.	A	15.	C	16.	B	17.	B	18.	C	19.	D	20.	A
21.	C	22.	A	23.	C	24.	D	25.	A	26.	B	27.	B	28.	A	29.	B	30.	C
31	D	32	D	33	D	34	C	35	A	36	A	37	A	38	B	39	B	40	A

ASSESS YOURSELF

1. **Thymus gland is involved in the maturation of**
   A) Platelets
   B) B-lymphocytes
   C) Eosinophils
   D) T-lymphocytes
2. **In passive immunity which of the following components are injected into body ?**
   A) Antigens
   B) Immunogens
   C) Serum
   D) Immunoglobulins
3. **_____ is not first line barrier**
   A) Skin B) Saliva C) Gastric D) Blood
4. **In antibody molecule, two heavy and two light chains are bonded by:**
   A) Disulphide Bond
   B) Monosulphide Bond
   C) Hydrogen Bond
   D) Ionic Bond
5. **Capacity to recognize intrusion of any foreign body is called**
   A) Transport B) Immunity C) Lymphatic system D) Inhibition
6. **Which of the following is a function of immunity**
   A) Reorganization of foreign body
   B) Protection of body systems
   C) Removal of foreign body
   D) All of these
7. **Which of the following provides protection against foreign invaders**
   A) Skin B) Immune system C) Mucous Membrane D) All of these
8. **It is a type of lymphocyte**
   A) T B) B C) A D) Both a & b
9. **Antibodies are special type of _____**
   A) Proteins B) Carbohydrates C) Lipids D) Vitamins
10. **An antibody molecule consists of:**
    A) Four polypeptide chains
    B) Three polypeptide chains
    C) Two polypeptide chains
    D) One polypeptide chain
11. **These are not immunoglobulins:**
    A) Antibodies B) Lymphocytes C) Platelets D) Both b & c
12. **Antigen destroyed by:**
    A) Antibody B) Foreign Particals C) Immunogens D) Both a & b
13. **It stimulates formation of antibody**
    A) Antigen B) Foreign substance C) Immunogen D) All
14. **Antibodies produced in**
    A) B-lymphocytes B) Monocytes C) T-lymphocytes D) Plasma cell
15. **Antibodies are secreted in**
    A) Lymph B) Blood C) Urine D) Both a & b
16. **Bursa of fibricuis is related to**
    A) B-lymphocytes B) Monocytes C) T-lymphocytes D) A-lymphocytes
17. **It in wall of cloaca of young bird, discovered**
    A) Monocytes B) T-lymphocytes C) B-Lymphocyte D) Neutrophils
18. **Antibody molecule consist of**
    A) Two identical light chain
    B) Two identical heavy chain
    C) Four identical heavy chain
    D) Both a & b
19. **Cell mediated response is performed by**

0.	C
0.	A
0.	C
0	A

A) B-lymphocytes B) Monocyte C) T-lymphocyte D) Both a & b

20. **Vaccine contains**
A) Antibodies B) Immunogeus C) Antigen D) Both b & c

21. **What type of immunity is achieved by injecting antibodies, antiserum, antivenom serum?**
A) Active immunity C) artificially induced immunity
B) Passive immunity D) naturally induced immunity

22. **Which one of the following glands is involved in the production of lymphocytes?**
A) Pineal B) Pituitary C) Thymus D) Adrenal

23. **Vaccine produce _____ in body**
A) Antigen B) Foreign particle C) Immunity D) antibody

24. **We can immune a person by using**
A) Antibiotics B) Drugs C) Antibody D) None of these

25. **A person immune against a particular disease for short period have**
A) Active immunity B) Forward immunity C) Passive immunity D) Reverse immunity

26. **The immunity acquired by inoculation of living organism of attenuated virulence is:**
A) Artificial active immunity C) Natural active immunity
B) Passive immunity D) innate immunity

27. **If we introduce dead viruses in a person this will termed as _____ induced active immunity**
A) Natural B) Self C) Artificial D) Mediated

28. **Auto immune response will seen in:**
A) Vaccination B) Antibiotics C) Infection D) none

29. **Antiserum contains**
A) WBCs B) Antigen C) RBCs D) Antibody

30. **To prevent a person from small pox we will use:**
A) Vaccine B) Antibiotics C) Antivenom D) Antiserum

31. **In tetanus infection we use**
A) Antigen B) Antibiotics C) Antibody D) Both b & c

32. **The method of passive immunization is not used to combat active infections of:**
A) Tetanus B) HAV C) Snake bite D) All of these

33. **Innate immunity is:**
A) Specific B) Non-specific C) Active D) Passive

34. **Acquired immunity can be developed by:**
A) Natural means B) Artificial means C) Both A and B D) None of these

35. **Among the components of immune system there are two types of:**
A) Phagocytes B) Monocytes C) Lymphocytes D) Leukocytes

36. **Pick up the disease which requires one time vaccination for protection in rest of the life:**
A) Measles and mumps C) Snake bite and tetanus
B) Rabies and Tetanus D) Snake bite and Rabies

37. **The immunity in which T cells recognize the antigens or microorganisms is known as:**
A) Tissue Grafting C) Cell Mediated Immunity / Response
B) Phagocytosis D) Hormonal Immunity / Response

38. **The immune system in body forms to attack and destroy specific Organism or toxins.**
A) Antigen C) Lymphocytes
B) Antibody D) Both antibodies and lymphocytes

39. **The antibodies are formed in:**

A) Bone marrow
B) Lymphoid tissue
C) Liver
D) Both in liver and lymphoid tissue

40. **Which part of the antibody recognizes the antigen during immune response?**
A) Heavy part
B) Variable part
C) Light part
D) Consonant part

CHAPTER 09

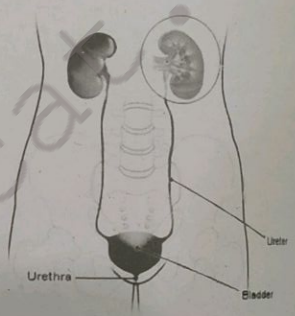
HOMEOSTASIS

COURSE CONTENT

- Homeostasis
- Thermoregulation in Mammals
- Human Urinary System

HOMEOSTASIS

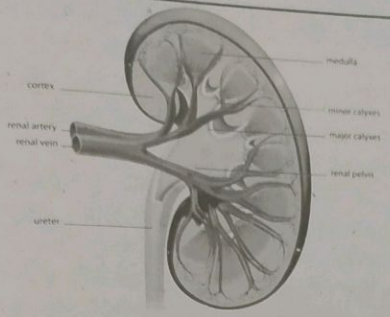
- "Homeostasis is the protection of internal environment from the harms of fluctuations in the external environment."
- However homeostasis doesn't mean to keep a fixed internal environment, despite of wide changes in external environment, as changes maintained within a specific range as necessary for normal body function.
- **"Osmoregulation is the mechanism of regulation, generally between organism and its environment, of solutes and the gain or loss of water is called osmoregulation".**



- **"The mechanism which eliminates nitrogenous waste is referred as excretion."**
- **"The mechanism by virtue of which internal temperature is maintained within a tolerable range is designated as thermoregulation."**

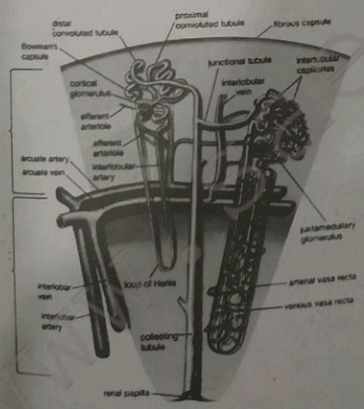
STRUCTURE AND FUNCTIONS OF KIDNEY

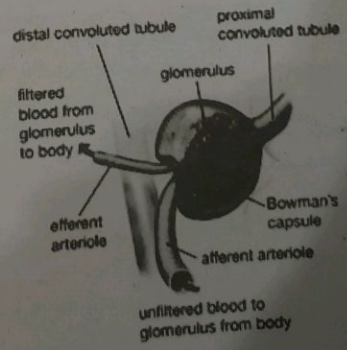
- ***Kidneys*** are not only one of the major excretory organs of humans but also act as an osmoregulator.
- Kidneys account for just ***1%*** of the body weight, while they receive 20% of blood supplied with each cardiac output.
- Basic functional unit of a kidney is called ***nephron***.
- Nephrons are of two types i.e. cortical and juxtamedullary.
- Those nephrons that are present along the border of cortex and medulla, with tubular system looping deep in inner medulla are called juxtamedullary nephrons.
- ***Juxtamedullary nephrons*** play important role in production of concentrated urine.



STRUCTURAL COMPONENTS OF NEPHRON WITH THEIR FUNCTION

Structure	Function
Bowman's capsule	Formation of Bowman's filtrate
Glomerulus	Cluster of capillaries receives blood from afferent arterioles & distributes to efferent arterioles. Glomerular walls are porous with slightly high blood pressure. It is involved in ***pressure filtration***.
Peritubular network	Network of capillaries around tubular part.
Proximal convoluted part	Reabsorption of all useful constituents of glomerular filtrate
Loop of Henle	Aldosterone acting on its thick loop / Counter-current multiplier mechanism.
Distal convoluted part	Reabsorption of water
Collecting tubules	Reabsorption of water under action of ADH
Vasa recta	Concentration of urine in case of juxtamedullary nephron.





MAINTAINING THE CONCENTRATION OF URINE AND PRODUCTION OF CONCENTRATED URINE

- In restricted water supply, kidneys excrete concentrated urine conserving most of the water (which may result from 99.5% of reabsorption of Glomerular filtrate in a mammalian kidney) Regulated by counter current and hormonal mechanisms.
- In excessive water supply, kidneys excrete dilute urine, an adaptation to ensure excessive water excretion. Regulated by inhibition of release of Antidiuretic Hormone.

COUNTER-CURRENT MULTIPLIER

- The interstitial fluid of kidney is gradually concentrated from cortex to medullary part.
- It maintains a high solute concentration in medulla.
- There is a gradual osmotic outflow of water from filtrate back to kidney as it moves downwards in the descending loop of Henle, since it is permeable to water.
- Ascending loop of Henle does not allow outflow of water from its filtrate, instead actively transport Na^+ into kidney interstitium to sustain its high concentration (controlled by aldosterone).
- Counter current multiplier plays the pivotal role in production of hypertonic (concentrated) urine in mammals including humans.

Hormonal control

- Aldosterone is secreted by adrenal cortex, regulates the active uptake of Na^+ in the ascending limb.
- Antidiuretic hormone (ADH) is secreted from posterior pituitary lobe, actively transport water from filtrate in collecting tubule back to kidney.

KIDNEY PROBLEMS AND CURE

KIDNEY STONES

- Stone formation in kidney and urinary tract, results in obstruction to flow of urine, increases susceptibility to infection and thus eventually leads to kidney failure.
- Different types of kidney stones are as follows:

Types of stones	%age	Cause
Calcium oxalate	70%	Hyperoxaluria (higher blood level of oxalates, Oxalates are present in green vegetables & tomatoes)
Calcium phosphate	15%	Hypercalcemia (high level of Ca^{2+} in the blood)
Uric acid	10%	Increased uric acid level

CURE

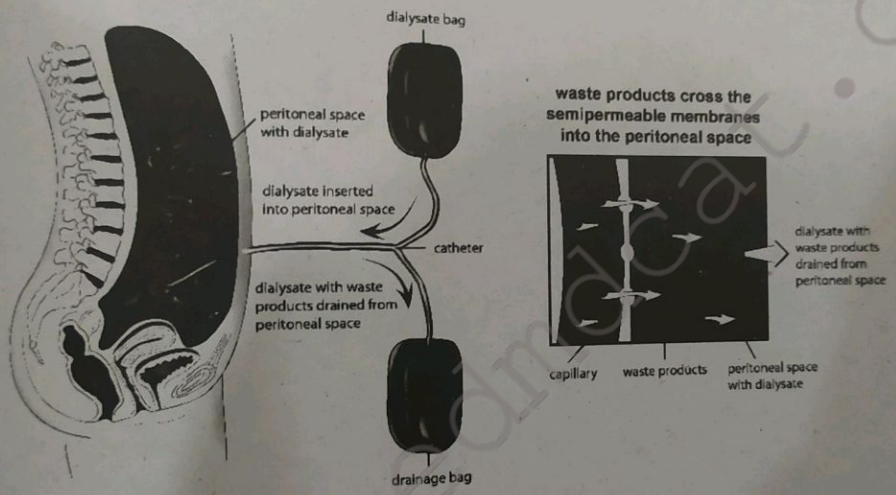
- **Lithotripsy** is used for non-surgical removal of kidney stones.
- **Extracorporeal shock wave lithotripsy** in the one opted for kidney stones. This is a minimal invasive surgery, in which kidney, pelvic or ureteric stones are broken down by bombarding ultrasounds or X-rays on them without giving any cut.
- Smaller stone pieces are flushed through ureter and then through urethra out of the body.
- **Renal surgery** is done for larger stones which can't be broken by lithotripsy technique, Direct surgical exposure and removal of stone is done.

RENAL FAILURE

- Failure of all the kidney functions i.e. excretory, osmoregulatory, hormonal (secretion of erythropoietin that helps in RBC formation) and metabolic function is called renal failure.
- Nephrons are destroyed particularly at glomerular part, leading to accumulation of urea, other waste materials, bone weakening and anemia.

CURE

- It is either dialysis or kidney transplantation.
- The process of artificially removing nitrogenous wastes is called **dialysis**.
- The waste materials e.g. urea from the blood, either by pass kidneys through an artificial kidney (dialysis machine) or filtering it within the abdomen.
- Dialysis is of two types i.e. peritoneal dialysis and hemodialysis.
- **Peritoneal dialysis** uses the peritoneum (inner lining of abdomen) to filter the blood present in peritoneal blood vessels.



- Peritoneal cavity is filled with dialyzing solution. Waste materials having high concentration in blood are filtered through peritoneum into the peritoneal cavity containing dialyzing solution, which is removed afterwards.
- Hemodialysis means cleaning the blood.
- Waste material in blood is filtered by passing it through a machine which contains a dialyzer also called

Artificial kidney.

- It is made of two spaces separated by a thin membrane. Blood flows inside the membrane in one direction and dialyzing fluid outside the membrane in another direction.

Renal Transplant

- It is considered permanent treatment. Since dialysis can only be done on temporary basis.
- Mostly opted in severe renal failure, called uremia or end-stage renal disease.
- Only a matched kidney can be transplanted in an individual.

OSMOREGULATION

- The mechanism of regulation, generally between organism and its environment, of solute and the gain and loss of water is osmoregulation.
- Water is solvent of the solutes in the cell. Each cell been adapted to defined quantity of water in relation to salts in it to perform its functions.

Water Relations to Cells

1. **Hypotonic Environment**

- Diluted solutions compared to the cell concentrationis designated as hypotonic environment.
- A solution in which the salt concentration is lower than that of another solution. The hypotonic environment osmotically causes entry of water into the cell and renders the cell solutions diluted which need to be regulated.
- **The plant cells become turgid while animal cells may be ruptured.**

2. **Hypertonic Environment**

- The more concentrated external environment is termed as hypertonic environment.
- A condition of a solution reflecting the presence of a solute concentration that is higher than that of some other solution. The hypertonic environment renders cell solutions concentrated and shrinks the cell due to loss of water which need to be regulated.

3. **Isotonic Environment**

- Environment that resembles to internal solution is called isotonic environment.
- There is no need of osmoregulation in such case. Such animals are called osmoconformers.

THERMOREGULATION

- Maintenance of internal temperature within a tolerable range is designated as thermoregulation.
- Animals are classified into three groups on base of thermoregulation i.e. ectotherm, endotherm and heterotherm.
- Animals that generate their own heat through heat production as by product during metabolism are **endotherms e.g. humans, birds, some fishes and flying insects.**
- Animals which produce metabolic heat at low level (that is also exchanged with the environment quickly) and absorb heat from surroundings are called **ectotherm e.g. most invertebrates, fish, amphibians and reptiles.**
- Animals which are capable of varying degrees of endothermic heat production but generally do not regulate their body temperature within a narrow range are **heterotherms e.g. bats, humming bird etc.**

THERMOREGULATORY ADAPTATIONS IN ANIMALS

ADAPTATION	EXAMPLES
Structural Adaptations	• Changes in sub – dermal fatty layer insulation. • Pelage • Sweat glands • Lungs modification for panting
Physiological Adaptations	• Change in habitat Change in body posture

Regulatory Strategies

Mammals including humans maintain their body temperature within a narrow range of about 36-38°C (36.1 – 37.8°C).

Hypothalamus is thermoregulatory center in humans.

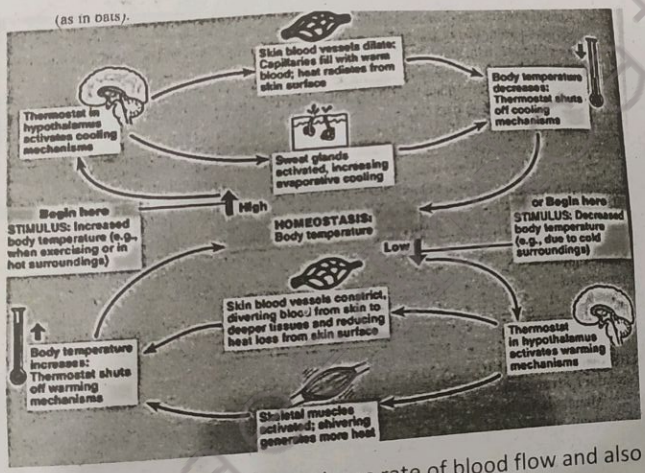
Strategies in Cold Temperature

The rate of heat production is increased by increased muscle contraction by movements or shivering so called shivering thermogenesis.

Hormones trigger the heat production as do thyroid hormones and are termed as non – shivering thermogenesis.

Some mammals have brown fat, which is specialized for rapid heat production.

Vasoconstriction occurs at skin which reduces rate of blood flow and also heat loss.



- Vasoconstriction occurs at skin which reduces rate of blood flow and also heat loss.
- Vasodilation occurs at trunk where most of the vital organs are located.
- Sweat glands are inactivated.
- Erection of hair in humans and raising of fur in others maintains body heat by trapping air and increasing insulation.
- Human mostly rely on a layer of fat beneath skin acting as insulating layer. Similarly marine mammals like whales and seals inhabit much colder water and have a thick layer of insulating fat called blubber just under the skin.

Strategies in warm Temperature

- Vasodilation occurs at skin which increases rate of blood flow and more heat loss.
- Heat dissipation occurs either through evaporation, radiation, conduction or convection.
- Sweat glands are activated which promote evaporative cooling. In some mammals, this evaporative cooling occurs respiratory tract (panting in dogs) or through saliva and urine (as in bats).

MCQs OF HOMEOSTASIS

1. **Non-surgical removal of kidney stones:**
   A) Dialysis B) Uremia C) Lithotripsy D) Radiotherapy
2. **Metabolism of which produces uric acid:**
   A) Protein C) Pyrimidine & purine
   B) Nucleic acid D) All of these
3. **Nephrons with loop of Henle and glomeruli in outer cortex are:**
   A) Juxta medullary B) Cortical C) Medullary D) Both A& B
4. **Flow through single nephron is represented by:**
   A) 2 capillary beds C) One set of arteriole & one venule
   B) 2 arterioles D) Both A& B
5. **Glomerular filtrate has same concentration as that of plasma except:**
   A) Blood cells B) Glucose C) Amino acids D) Salts
6. **Most of the Na, K, Cl, bicarbonate, glucose, amino acids etc are reabsorbed in:**
   A) Proximal tubule B) Distal tubule C) Ascending limb D) Loop of Henle
7. **Which is diluting segment of nephron:**
   A) Distal tubule B) Proximal tubule C) Ascending limb D) Descending limb
8. **One kidney receives _____ blood during one circulation**
   A) 10% B) 20% C) 30% D) 40%
9. **Dialysis means:**
   A) Fractionation B) Filtration C) Dissolution D) Centrifugation
10. **What can be done in chronic renal failure on permanent basis:**
    A) Transplant B) Dialysis C) Artificial kidney D) None
11. **Which acts as semi permeable membrane during peritoneal dialysis:**
    A) Pleura B) Wall of gut C) Both D) Blood vessels
12. **Which is the sign of renal failure?**
    A) High blood pressure C) Enzyme denaturation
    B) Anemia D) All
13. **A pair of kidney consists of _____ of functional units:**
    A) Millions B) Billions C) Thousands D) Trillions
14. **Kidney accounts for less than _____ percent of total body weight:**
    A) 0.5 B) 1 C) 10 D) 20
15. **Urethra empties near _____ in females?**
    A) Ureter B) Vagina C) Uterus D) Clitoris
16. **Upper part of ureter where it begins is:**
    A) Pelvis B) Pyramids C) Hillus D) None of them
17. **Most susceptible component of internal environment is:**
    A) Water B) Temperature C) Solutes D) All of these
18. **Kidney stones are formed due to**

A) Kidney disorder
B) Metabolic disorders
C) Cardiac disorders
D) None of them

19. **Conversion of excess amino acids into urea is done by?**
A) Lungs B) Liver C) Large intestine D) Small intestine

20. **Man is?**
A) Ammoniotelic B) Ureotelic C) Uricotelic D) Both b and c

21. **Excessive lactic acid is converted into _____ by liver.**
A)Glucose B)Sucrose C)Fructose D)Glycogen

22. **Which of the vascular channels are related to Juxtramedullary nephrous only?**
A)Afferent and efferent arterioles
B)Vasa nervosa
C)Peritubualr capillaries
D) Vasa recta

23. **Which is not a poikilotherm?**
A) Invertebrates B) Reptiles C) Amphibians C) Birds

24. **Kidney stones are formed in:**
A) Kidney
B) Ureter
C) Gall bladder
D) Gall bladder, ureter and kidney all

25. **Which of the following filtrate contains excessive amount of amino acids, glucose, and salts?**
A) Glomerular filtrate
B) Filtrate passing through distal conveluted tubule
C) Filtrate passing through ascending limb
D) Filtrate passing through collecting tubules

26. **Which of the following constituent is/are maximum in the filtrate that leaves proximal convoluted tubules?**
A) Glucose B) Nitrogenous waste C) Amino acids D)All of these

27. **A decreased water supply to body results in increased secretion of:**
A) ADH B) Sugar C) Insulin D) Glucagon

28. **Mammalian kidney, under restricted water supply can conserve water by over _____ % reabsorption of glomerular filtrate**
A)80.50% B)95.50% C)90.50% D)99.50%

29. **A decreased water supply to body results in increased secretion of:**
A) ADH B) Sugar C) Insulin D) Glucagon

30. **On which of the following site the posterior pituitary hormone acts predominantly**
A)Proximal convoluted tubule
B)Ascending limb of loop of Henle
C)Descending limb of loop of Henle
D) Collecting tubules

31. **A stone measuring 0.4 cm, blocking the outlet of renal pelvis resulting in mild to moderate tract obstruction. Which of the following technique will be opted to remove this stone?**
A)Kidney surgery
B)Burring a hole and removing the stone manually (Nephrolithotomy)
C)Extracorporeal Shock wave lithotripsy
D)None of these

32. **Which of the following treatment will be administered first in a newly diagnosed renal failure patient?**
A)Renal transplant B)Lithotripsy C)Peritoneal Dialysis D)Hemodialysis

33. **Animals that produce metabolic heat at low level and also absorb heat from the surroundings are called:**
A)Endotherms B) Heterotherms C) Ectotherms D) Homeotherms

34. **The nephrons have extensive blood supply via:**
A) Renal arteries B) Renal veins C) Afferent arterioles D) Efferent arterioles

35. **Urine is collected in a central cavity of kidney called:**
A) Renal hilus B) Renal pelvis C) Urinary Bladder D) Collecting tubule

36. **Which one of the following is a source of hyperoxaluria:**
A) Green vegetables and tomatoes C) Infectious disorder
B) Hormonal imbalance D) Kidney failure

37. **Blood leaves the Bowman's capsules by:**
A) Renal artery B) Renal vein C) Efferent arteriole D) Afferent arteriole

38. **Blood passing through glomerulus is filtered into:**
A) Glomerulus B) Proximal tubule C) Bowman's capsule D) Loop of Henle

39. **In restricted supply of water, the principal function of body is:**
A) Conservation of water C) Production of water
B) Concentration of water D) Removal of water

40. **Podocytes are specialized cell having numerous processes which rest on the basement membrane. These are:**
A) Epithelial cell of Bowman's capsule of kidney
B) Epithelial cell of glomerulus of kidney
C) Endothelial cells of peritubular cepilaries
D) Endothelial cells of vasa rectae

Answers:

1.	C	2.	D	3.	B	4.	D	5.	A	6.	A	7.	A	8.	A	9.	B	10.	A
11.	B	12.	D	13.	A	14.	B	15.	B	16.	A	17.	A	18.	D	19.	B	20.	B
21.	D	22.	D	23.	C	24.	A	25.	A	26.	B	27.	A	28.	D	29.	A	30.	D
31	C	32	D	33	C	34	A	35	B	36	A	37	C	38	C	39	A	40	A

ASSESS YOURSELF

1. **Which one of the following is the main nitrogenous waste product in humans ?**
   A) Urea B) Ammonia C)Salts D) Uricacid
2. **Water is reabsorbed in nephron by actively pumping sodium ions from filtrate. This task is accomplished by:**
   A) ADH B) Oxytocin C) Insulin D) Aldosterone
3. **Peritubular capillaries are part of:**
   A) Glomerulus B) Afferent arteriole C) Efferent arteriole D) Vasa recta
4. **Pressure filtration at glomerulus level is because of:**
   A) Glomerulus walls are porous
   B) Gaps between podocytes
   C) Blood Pressure in capillaries of glomerulus
   D) Glomerulus walls are porous, Blood Pressure in capillaries of glomerulus, Gaps between
5. **Among vertebrates, uric acid is the chief nitrogenous waste in birds and:**
   A) Fishes B) Reptile C) Amphibians D) Mammals
6. **Pick correrct pathway of urine flow:**
   A) Collecting Duct → Renal Pelvis → Ureter → Urinary Bladder → Urethra
   B) Renal Pelvis → Ureter → Urinary Bladder → urethra → Renal Pelvis
   C) Collecting Duct → Ureter → Urinary Bladder → urethra → Renal Pelvis
   D) Urethra → Collecting Duct → Renal Pelvis → Ureter → Urinary Bladder
7. **The vegetarians are at risk of _____ types of kidney stones:**
   A) Calcium phosphate B) Calcium oxalate C) Uric acid D) Calcium carbonate
8. **In extra corporeal shock wave lithotripsy (ECSWL) _____ are used:**
   A) Gamma ray B) Infrared waves C) Ultrasound D) Microwaves
9. **Functions of kidney include(s)?**
   A) Water conservation/retention
   B) Excretion of nitrogenous waste
   C) Regulation of blood salt balance
   D) Water conservation/retention, Excretion of nitrogenous waste and Regulation of blood salt balance
10. **True about dialyzer:**
    A) Permanent solution of kidney failure
    B) Active removal of nitrogenous wastes form blood
    C) Complete solution of kidney replaces
    D) It is done again and again in patients
11. **Stony materials are formed in the kidney all of the following EXCEPT:**
    A) Uric acid B) Urea C) Oxalate D) Calcium
12. **In restricted supply of water the conservation of water (osmoregulation) can bring about:**
    A) Counter current mechanism
    B) Enzymatic mechanism
    C) Hormonal mechanism
    D) Counter current mechanism, Hormonal mechanism
13. **In an artificial kidney the wastes and excess water pass from the blood through the membrane into the dialysis fluid by mechanism:**

A
B
D
A

A) Diffusion B) Osmosis C) Active transport D) Exocytosis

14. Lithotripsy is applied on:
A) Kidney, urinary bladder, gall bladder C) Urinary bladder, kidney, intestine
B) Gall bladder, kidney, liver D) Urinary bladder, kidney, liver

15. Renal vein leaves the kidney through:
A) Pelvis B) Renal Hilus C) Bowman's capsule D) Cortex

16. Highly toxic nitrogenous excretory product is:
A) CO_2 B) Uric acid C) Urea D) Ammonia

17. Humans have homeostatic thermostat present in a specified portion of the brain that is:
A) Lateral ventricle B) Thalamus C) Spinal cord D) Hypothalamus

18. Choose the false one?
A) Left kidney is slightly higher than the right one
B) Both kidneys are protected by floating ribs
C) Both kidneys are bean shaped curved towards the vertebral column
D) Kidney is the accumulation of smaller tubule like seminiferous structures

19. Podocytes are found in nephron at the location of?
A) External wall of glomerulus C) Internal wall of glomerulus
B) External wall of bowmans capsule D) Internal wall of bowmans capsule

20. Stone and insoluble mass of crystallized salts, formed within the kidney, is generally made up of?
A) Calcium carbonate B) Silica C) Calcium oxalates D) All of these

21. In peritoneal dialysis, peritoneal cavity is filled with dialysis fluid that is introduced into the body through:
A) Vein B) Catheter C) Shunt vein D) Urethra

22. Which one is not a nitrogen waste?
A) Hypoxanthine B) Xanthophyll C) Glucose D) Allantoin

23. Right kidney is slightly lower than left kidney due to:
A) Heart B) Liver C) Pancreas D) Lungs

24. Capillaries present around the loop of Henle:
A) Vasa recta B) Peritubular C) Lacteals D) Glomerulus

25. The only possible treatment in end stage renal failure is:
A) Hemodialysis B) Peritoneal dialysis C) Lithotripsy D) Kidney transplantation

26. It is not a function of kidney:
A) Excretion B) Osmoregulation C) Formation of urine D) Formation of urea

27. Which of the following is in equal amount in afferent and efferent arteriole of nephron?
A) Urea B) Water C) Amino Acids D) RBCs

28. Which of the following statement is true?
A) Thin loop of Henle does not allow out flow of water
B) Descending loop of Henle allow out flow of sodium
C) Ascending limb actively transport Na+ ions
D) Aldosterone acts on collecting ducts

29. It is a complication associated with renal stones:
A) Failure of filtration C) Urinary retention
B) Failure of urea formation D) Blockage of bile duct

30. It can be the organ of thermoregulation in humans:
A) Liver B) Lungs C) Kidney D) Skin

31. **Nitrogenous wastes are produced from breakdown of:**
A) Proteins & Nucleic acids
B) Carbohydrates & Lipids
C) Carbohydrates & Proteins
D) Lipids & Nucleic Acids

32. **Second ammonia molecule in urea cycle combines with:**
A) Citrulline B) Ornithine C) Arginino succinate D) Arginine

33. **Hag fishes are:**
A) Osmoconformers
B) Osmoregulators
C) Thermoregulators
D) Sometimes osmoconformers but mostly osmoregulators

34. **Animal cell will shrink if it is placed in a _____ solution:**
A) Hypotonic B) Hypertonic C) Isotonic D) Hyperosmotic

35. **Capillaries present around the loop of Henele:**
A) Vasa recta B) Peritubular C) Lacteals D) Glomerulus

36. **Which of the following is in equal amount in afferent and efferent arteriole of nephron?**
A) Urea B) Water C) Amino AcidsD) RBCs

37. **It is a complication associated with renal stones:**
A) Failure of filtration
B) Failure of urea formation
C) Urinary retention
D) Blockage of bile duct

38. **Part of nephron involved in active reabsorption of sodium?**
A) PCT
B) DCT
C) Descending limb of loop of henle
D) Ascending limb of loop of henle

39. **The number of nephrons in a kidney is equal to the**
A) Number of bowman capsules
B) Double of the number of bowmans capsule
C) Sum of bowman capsules and glomeruli
D) Sum of bowmans capsule and PCT

40. **The function of efferent arteriole is related to nephron as it helps in:**
A) Pressure filtration
B) Secretion
C) Reabsorption
D) Pressure filtration and Secretion

CHAPTER 10

MUSCLES AND MOVEMENT

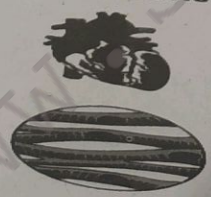
COURSE CONTENT

- Structure and Function of Skeletal Muscle
- Mechanism of Skeletal Muscle Contraction: Sarcomere, Ultrastructure of Myofilaments, Sliding Filament, Control of Actin – Myosin Interaction and use of Energy for Muscle Contraction.

TYPES OF MUSCLES

PROPERTY	SMOOTH	CARDIAC	SKELETAL
Muscle appearance	Unstriped (non striated)	Irregular stripes (striated)	Regular stripes (striated)
Cell shape	Spindle	Chain of cells organized in to branched and interconnected fibers	Cylindrical
Number of nuclei	One per cell	Many per cell	Many per cell
Speed of contraction	Slow	Intermediate	Slow to rapid
Contraction caused by	Spontaneous, stretch, nervous system, hormones	Spontaneous	Neuronal signals.
Function	Controls movement of substances through hollow organs	Pumps blood	Moves the skeleton
Control	Autonomic (involuntary)	Involuntary	Voluntary
Location.	Blood vessels, GIT, other hollow organs	Heart.	Attached to skeleton via tendons (non-elastic collagenous fibers), and thus associated with the movement of bones

Cardiac muscle



Skeletal muscle

Smooth muscle

ROLE OF SKELETAL MUSCLES

- ***Origin*** is end of muscle which remains fixed when muscle contracts.
- ***Insertion*** is the end of muscles that moves the bone.

FEATURE	TENDONS	LIGAMENTS
Attachment	Skeletal Muscle to Bone	Bone to Bone
Elasticity	Inelastic	Elastic
Strength	Tough	Strong
Composition	White fibrous tissues	Yellow elastic tissues* Collagens
Structure	Dense Parallel fibres	Dense Non-Parallel fibres

Antagonistic

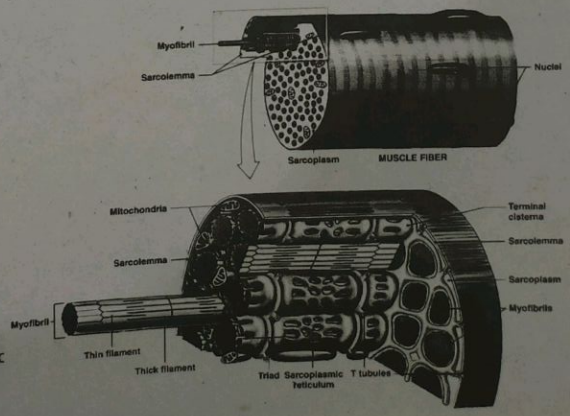
- At joints, muscles work against each other by contraction.
- Pair of muscle in which one member contracts while other relaxes, so reverse the effect of each other and do not contract simultaneously is called antagonism.
- There are ***650 muscle in Human body***, most of which are in antagonistic arrangement.

Muscle	Origin	Insertion	Function
Biceps	By two heads from scapula	Medical surface of radius	Lifts radius (flexion)
Brachialis	Humerus	Ulna	Lifts ulna (flexion)
Brachioradialus	Humerus	Radius	Lifts radius (flexion)
Triceps	By three heads from scapula &humerus	Olecranon process of ulna	Straightens elbow (extension)

PROCESS OF MUSCLE CONTRACTION

STRUCTURE OF SKELETAL MUSCLE

- Skeletal muscles → Mucsle bundles → Muscle fibers → Myofibrils → Sarcomere (smallest contractile unit of muscle fiber) → Myofilaments (Action & Myosin)
- Shape: long cylindrical
- Size: 10 – 100 µm in Diameter.
- Sarcolemma: is the surrounding membrane of muscle fiber.
- Sarcoplasm: is the fuild part of the muscle fiber, is just like cytoplasm except it contains large amount of glycogen and O_2 bonding protein called myoglobin that stores O_2.
- Nuclei: multinucleated.
- Myofibrils: Bundles of 1-2 µm in diameter, running in parallel fashion up to the entire length of muscle fiber, enclosed by its membrane the sarcolemma.
- Sarcomere: present in myofibrils and is the smallest contractile unit of muscle fiber. This is the area between two successive Z-lines.
- A – Band: A (Anisotropic or polarizing) band is the dark band of sarcomere. Here both actin and myosin are present.
- I – Band: I (isotropic or non-polarizing) band is the light one. Here only actin is present. These alternating light and dark bands give the cell striated appearance.

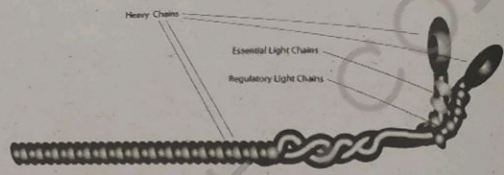


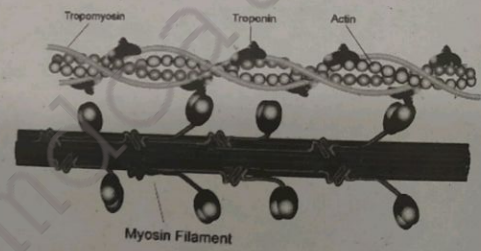
- H – Zone: a lighter zone in the mid of A band. (H–Hele meaning bright).
- M – Line: A darker line in the centre of H-zone.
- Z – Line: A line in the centre of I-Band. (Z–Zwishen means between). From here actin filaments arise.
- Motor Unit: All the muscle fibers innervated by a single motor neuron, which contracts simultaneously in response to the action potential fired by the motor neuron.
- Transverse (T) Tubules & T System:
  - Hollow elongated tubes penetrating the cell
  - Formed by invagination of sarcolemma
  - Continuous with extracellular fluid
  - Are also related with sarcoplasmic reticulum to form a triad
  - All the T- tubules of each muscle cell are collectively called T- System.
  - It extends and encircles the myofibril at the level of Z- line or A – I Junction.

Ultra Structure of Myofilaments

Myosin

- There are thick filaments, extending through entire length of A – band.
- Diameter is 16 nm.
- Each actin molecule consists of a tail and two globular heads. Tail consists of two long polypeptide chains coiled together. Heads globular in shape, also called cross bridges, since they link and thin myofilaments together during contraction.





Actin

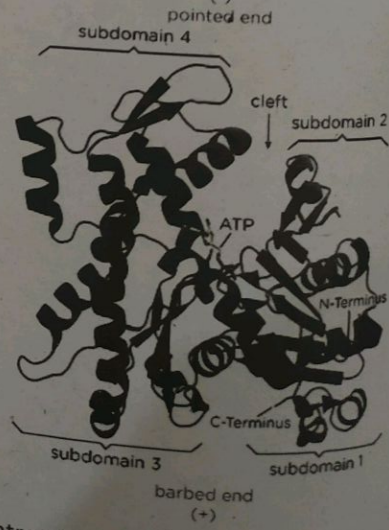
- These thin filaments extend across the I-band and partly into A – band.
- Thin filaments are 7 – 8 nm thick.
- Each actin molecule consists of two chains which twist around each other like twisted double strands of pearls.
- Two more proteins are present in relation to these thin filaments:

Tropomyosin

- It is present in the grooves of double helix structure of actin molecules during resting condition.
- It covers those active sites on actin molecules which are meant to interact with myosin molecule during muscle contraction.

Troponin

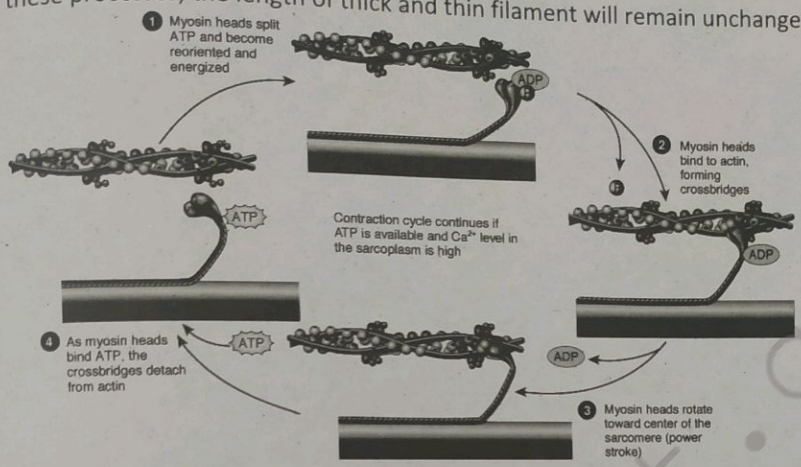
It is composed of three polypeptide complex, one binds to actin, another binds to tropomyosin, while third binds to Ca^{2+} ions.



SLIDING FILAMENT MODEL

- H. Huxley and A.F. Huxley suggested this model of muscle contraction.

- Cross bridges of thick filaments become attached to the binding site on the actin filaments. This pulls the actin filaments become towards the centre of the sarcomere.
- All these events result in shortening of I- band, approximation of Z-line and disappearance of H-zone.
- During all these processes, the length of thick and thin filament will remain unchanged.



The Mechanism

- Muscle contraction is initiated by nerve impulse arriving at neuromuscular junction, which is carried through T-tubules to sarcoplasmic reticulum, cause them to release Ca^{2+} in sarcoplasm.
- Ca^{2+} binds to troponin, this results in uncovering of actin binding sites by tropomyosin.
- Myosin cross bridges attach to actin binding sites, which result in their overlapping and contraction occur.
- 1 band → Shorten.
- Z – line → get closer.
- H – zone → disappear.

All or None Response

- All the fibrils of a muscle fiber will contract collectively in a particular contraction. However the degree of contraction depends upon the number of participating fibers.
- Rigor Mortis is stiffening of the body after death. Since ATP is required to break the bond between actin and myosin, which get deficient after death, thus the bridges can't be broken and the body gets stiff.

Energy for the Muscle Contraction

UNDER NORMAL CONDITIONS

Stored glycogen in the cell

↓

Glucose → Aerobic breakdown → **ATP**

UNDER STESS FULL CONDITIONS
(high metabolic activity e.g. exercise)

1) Creatine phosphate
2) Glucose → Lactic acid
(Anaerobic breakdown)

Lactic acid → 1/5 broken aerobically
4/5 → Glucose

EFFECT OF EXERCISE ON MUSCLES

- Increase in size of the muscle.
- Increase in its strength.
- More efficient and fatigue resistant.
- Capillaries surrounding muscle fibers and mitochondria in it increases.
- Synthesize more myoglobin.

#	MUSCLE FATIGUE	TETANY	TETANUS	CRAMPS
DEFINITION	State of physiological inability to contract	Disease due to low blood calcium	Acute infectious disease caused by anaerobic bacterium	Tetanic contraction of entire muscle
CAUSES	• Relative deficiency of ATP • Ionic imbalance • Accumulation of lactic Acid • Low pH • Glucose breakdown	• Low calcium level in blood	• Anaerobic bacterium Clostridium tetani	• Low blood sugar level • Electrolyte depletion • Dehydration • Irritability of spinal cord and neurons
SYMPTIOMS	• Muscle ache	• Excitability of neurons • Loss of sensation • Muscle twitches • Muscle convulsions • Spasm of larynx • Respiratory paralysis • Death	• Painful spasm of some skeletal muscles • Stiffness of jaws and neck muscles • Rigidity of jaws (lock jaw) • Spasm of trunk and limb muscles • Respiratory failure	• Taut and painful muscles mostly of thigh and hip muscle and lasts for few seconds to several hours

MCQs OF MUSCLES AND MOVEMENT

1. **Which type of muscles have branched structure:**
   A) Skeletal muscles B) Striated muscles C) Cardiac muscles D) Smooth muscles
2. **Which one of following has autonomic nerve supply:**
   A) Unstriated muscles B) Striated muscles C) Heart muscles D) Biceps and triceps
3. **The binding site is present on which myofilament?**
   A) Actin B) Troponin C) Tropomyosin D) Troponin C
4. **Which one of following has fixed attachment:**
   A) Origin B) Insertion C) Tendon D) All of these
5. **Each "A" band has a lighter stripe in its mid – section, called:**
   A) I – zone B) M – zone C) H – zone D) Median line
6. **Term "Hele" means:**
   A) Dark B) Hollow C) Compact D) Bright
7. **A sarcomere is the region of a myofibril between two successive:**
   A) A – lines B) H – line5s C) Z – lines D) M – lines
8. **Myofibrils contain:**
   A) Myofilaments B) Thick filaments C) Thin filaments D) Muscle fibres
9. **Twisting around the actin chains are two strands of another protein:**
   A) Troponin B) Tropomyosin C) Myosin D) Collagen
10. **Sarcolemma of muscle fiber cell penetrates deep into the cell to from hollow elongated tube the:**
    A) Transverse tubule B) Microtubules C) T-tubule D) Both a & c
11. **Lock Jaw is the symptom of:**
    A) Tetany B) Tetanus C) Cramp D) Fatigue
12. **Tendons attach muscle to:**
    A) Muscle B) Bones C) Ligament D) Cartilage
13. **Which is not the character of skeletal muscle:**
    A) Somatic control C) One nucleus per cell
    B) Regular Stripes D) Slow to rapid movement
14. **Vertebral column includes:**
    A) Cervical vertebrae B) Thoracic vertebra C) Lumbar vertebrae D) All of these
15. **Chondrocytes are the living cells of:**
    A) Bone B) Cartilage C) Muscles D) Tendon
16. **Pivot type joint is present between:**
    A) Radius , ulna&humerus C) Radius & carpals
    B) Ulna & carpals D) Carpals and phalanges
17. **In thin filament there are _____ actin chains:**
    A) 2 B) 4 C) 8 D) 6
18. **How many bones are found in forelimb beyond elbow:**
    A) 27 B) 28 C) 29 D) 30
19. **Ligament & tendon:**
    A) Both are inelastic C) Elastic, inelastic respective
    B) Both are elastic D) Inelastic, elastic respectively
20. **Sarcoplasmic reticulum releases calcium to cytosol which binds to:**
    A) Tropomyocin B) Myosin C) Troponin D) Actin

21. Skeletal muscles appear striated due to presence of two characteristics proteins in alternating and light bands. Which of the following is a correct match of the protein with its light refra property and colour?

	Protein	Colour	Property
A)	Myosin	Light	Anisotropic
B)	Actin	Dark	Anisotropic
C)	Myosin	Dark	Isotropic
D)	Actin	Light	Isotropic

22. The lumen of the T – tubules of sarcolemma is continuous with:
A) Intercellular fluid
B) Extracellular fluid
C) Intracellular fluid
D) Lumen of the cell

23. Contractures or state of continuous contraction results because the bridges are unable to detach
A) Muscle fatigue
B) Tetany
C) Cramp
D) Tetanus

24. The function of the T tubules in muscle contraction is to:
A) Carry the impulse into the myofibrils of the muscle cell.
B) Release calcium ions.
C) Release sodium ions.
D) Split ATP.

25. At the start of a muscle contraction, calcium ions are released from:
A) Acting.
B) The T tubule.
C) The motor neuron.
D) The sarcoplasmic reticulum.

26. The sarcomere is the functional contractile unit found in:
A) Nuclei
B) Capillary
C) Myofibril
D) Sarcoplasmic reticulum

27. The function of sarcoplasmic reticulum is:
A) To store and release calcium ions
B) To polarize and depolarize sarcolemma
C) To store energy as creative phosphate
D) To generate a train of nerve impulse

28. Sarcomere is distance between:
A) Two I-bands
B) Two Z-lines
C) A and I bands
D) Z and A bands

29. Skeletal Muscle is:
A) Voluntary and Spindle Shaped
B) Voluntary and Striated
C) Involuntary and Spindle Shaped
D) Involuntary and Striated

30. It can provide protection to genital organs:
A) Vertebral Column
B) Palatine
C) Cranium
D) Pelvis

31. Cardiac Muscle is:
A) Voluntary and Spindle Shaped
B) Voluntary and Striated
C) Involuntary and Spindle Shaped
D) Involuntary and Striated

32. Which one of the following is wrongly matched?
A) Myosin-Contractile protein
B) Tendon-Connective tissue
C) Smooth Muscle-Involuntary muscle
D) Troponin-Fibrous protein

33. When muscle is required to contract, calcium ions bind with the:
A) Tropomyosin molecule
B) Actin molecule
C) Troponin molecule
D) Collagen molecule

34. **Smooth Muscle is:**
A) Voluntary and Spindle Shaped
B) Voluntary and Striated
C) Involuntary and Spindle Shaped
D) Involuntary and Striated

35. **Which type of muscle cell is multinucleated?**
A) Cardiac
B) Skeletal
C) Smooth
D) All of the Above

36. **The "Insertion" is attached to the:**
A) Moveable bone
B) Immoveable bone
C) Porous bone
D) Compact bone

37. **They provide maximum flexibility:**
A) Ball and socket joint
B) Hinge joint
C) Pivot joint
D) Saddle joint

38. **When viewed in high magnification, each muscle fibre is seen to contain a large number of:**
A) Muscle bundles B) Muscle cells C) Myofilaments D) Myofibrils

39. **Diameter of a myofibril is**
A) 1 – 2 μ m B) 10 – 100 μ m C) 7 – 8 μ m D) 16 μ m

40. **It can polarize visible light:**
A) A – band of sarcomere
B) I – bond of sarcmere
C) H – band of sarcomere
D) M – line of sarcomere

Answers:

1.	C	2.	C	3.	S	4.	A	5.	C	6.	D	7.	C	8.	A	9.	B	10.	D
11.	B	12.	B	13.	C	14.	D	15.	B	16.	A	17.	A	18.	C	19.	C	20.	C
21.	D	22.	B	23.	B	24.	A	25.	D	26.	C	27.	A	28.	B	29.	B	30.	D
31	D	32	A	33	C	34	C	35	B	36	A	37	A	38	D	39	A	40	A

ASSESS YOURSELF

1. **When cross bridges contract they pull the actin filament towards the:**
   A) Centre of the sarcomere
   B) Ends of the sarcomere
   C) Right side of the sarcomere
   D) Left side of the sarcomere
2. **It is a disease caused by low calcium in the blood:**
   A) Muscle fatigue B) Tetany C) Cramp D) Tetanus
3. **Which one of the following is an example of a non-elastic connective tissue?**
   A) Ligaments. B) Tendon C) Muscles. D) Cartilage
4. **Type of muscle having regular striations and many nuclei per cell:**
   A) Smooth muscles
   B) Cardiac muscles
   C) Skeletal muscles
   D) Cartilage muscles
5. **Which of the following step occurs immediately after binding of Ca2+ with troponin molecule during muscle contraction.**
   A) Binding sites of actin get attached to the myosin head
   B) Troponin uncovers the actin binding sites.
   C) Tropomyosin gets removed from the binding sites of actin filaments.
   D) Ca2+ goes back inside sarcoplasmic reticulum.
6. **It is a long cylindrical cell with multiple oval nuclei arranged just beneath its sarcolemma:**
   A) Muscle B) Muscle bundle C) Skeletal muscle D) Muscle fibre
7. **There is a regular alteration of light and dark bands called the _____ respectively:**
   A) I – band and A – band
   B) A – band and I – band
   C) M – line and A – band
   D) Z – line and I – band
8. **The region of a myofibril between two successive Z – lines is called:**
   A) Isomers B) Sarcomere C) Sacroprasma D) Sarcolemma
9. **In muscle contraction under anaerobic conditions ATP can be generated by:**
   A) Citric acid cycle B) Krebs cycle C) Glycolysis D) ETC
10. **The protein that is complex of three polypeptide chains is called:**
    A) Tropomyosin B) Actin C) Myosin D) Troponin
11. **T – tubule and the terminal portion of the adjacent envelope of sarcoplasmic reticulum form:**
    A) Z – line B) Triads C) H – zone D) T – system
12. **Why skeletal muscles are called striated muscles?**
    A) They appear darker than smooth muscles by naked eye.
    B) Alternating dark and light bands appear on their surface when visualized by naked eye.
    C) Alternating dark and light bands appear on their surface when visualized via a microscope.
    D) All of these
13. **Which of the following bone is not present in the hind-limb?**
    A) Femur B) Tibia C) Radius D) Fibula
14. **The cytoplasm of the muscle cell that contains large amount of stored glycogen and myoglobin:**
    A) Sarcolemma B) Protoplasm C) Axoplasm D) Sarcoplasm
15. **Myofibril consists of many thread like structures called:**
    A) Actin filaments B) Myosin filaments C) Myofilaments D) Intermediate filaments
16. **Cyclic activity of cross bridges is regulated by:**
    A) Ca^{+2} ions B) ATP C) Troponin D) Actin

17. **Generally each end of entire muscle is attached to bone by a bundle of collagen, non-elastic fibers known as**
A) Tendons B) Connective C) Ligaments D) All of these

18. **Which of the following is bacterial infection ?**
A) Muscle fatigue B) Tetany C) Tetanus D) Cramp

19. **These muscles are innervated by autonomic nerves:**
A) Smooth muscles C) Cardiac muscles
B) Skeletal muscles D) Cardiac and smooth muscles

20. **These are embedded within the sarcoplasm EXCEPT:**
A) Nuclei B) Mitochondria C) Glycogen D) Starch

21. **At rest _____ lactic acid change into glucose:**
A) 4/5 B) 1/5 C) 2/5 D) 3/5

22. **All of the following are true about skeletal muscles except:**
A) Striated B) Uninucleate C) Voluntary D) Movement

23. **The skeletal muscles are attached with bones through:**
A) Tendons B) Sarcolemma C) Myofibrils D) Ligaments

24. **Striated or skeletal muscle responsible for voluntary movement is under the control of the:**
A) Sympathetic nervous system C) Parasympathetic nervous system
B) Somatic nervous system D) All of the above

25. **Which of these statements is correct regarding muscle contraction?**
A) All motor units act together.
B) Muscle contraction continues for long periods after nervous stimulation ceases.
C) The cross bridges bind to the actin and shorten the sarcomeres
D) Magnesium is needed to strengthen the contracting muscle cell.

CHAPTER 11

COMMUNICATION

COURSE CONTENT

- Nervous Coordination in Mammals
- Neurons: Sensory, Intermediate / relay and motor neurons
- Reflex are / Reflex action
- Nerve impulse
- Synapse
- Hormones: Definition & Types of Hormones, Hormones of islets of Langerhans (Insulin & Glucagon) and Role of ADH in Osmoregulation.
- Plants Hormones: Auxins, Gibberellins and Abscisic Acid

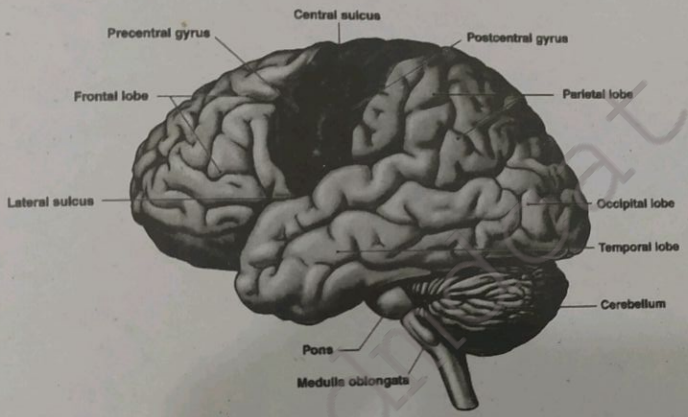
NERVOUS SYSTEM AND ITS TYPES

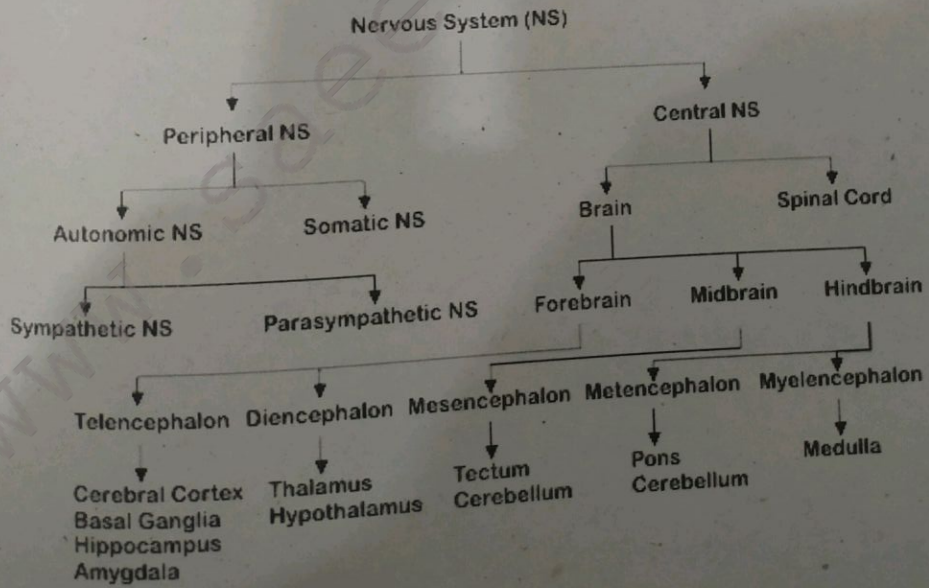
Features	Diffused Type	Centralized Type
Brain	NO	YES
Specialized Neurons	NO	YES
Sense Organs	NO	YES
Nervous	NO	YES
Phylum	Cnidaria	Platyhelminthes to Chordata
Example	Hydra	Planaria

NERVOUS SYSTEM AND ITS TYPES

Brain	Parts	Subparts	Functions
Forebrain	Thalamus		Relay station for sensation from eye, ear, skin & internal receptors.
	Limbic system	Hypothalamus	Hormone production, coordinating center, control body temperature, hunger, menstrual cycle, water balance, sleep-wake cycle.
		Amygdala (cluster of neurons)	Sensation of pleasure, punishment, sexual arousal, feeling of fear & rage
		Hippocampus	Long-term memory, learning
	Cerebrum	Largest part, two halves (cerebral hemispheres) communicating with corpus callosum (band of axons), outer cerebral cortex forming convolutions (increasing	Receives sensory information, processes it, stores in form of memory, direct voluntary movement, responsible for thinking, intelligence, reasoning, judgment. Sensory area, speech area, motor area, right cerebral hemisphere controls left side of body and left cerebral hemisphere controls

		surface area)	right side of the body.
Midbrain (reduced in human)	Reticular formation		Relay center connecting hindbrain with forebrain, screening input information, contains auditory relay station.
Hindbrain	Pons		Influence transition between sleep & wakefulness, controls rate & pattern of breathing
	Medulla		Controls autonomic functions e.g. breathing, heart rate, blood pressure, swallowing
	Cerebellum (best developed in birds)		Coordinates voluntary movements, guides smooth & accurate motions, maintains body position, learning & memory storage for behaviours.





PERIPHERAL NERVOUS SYSTEM & ITS TYPES

- It consists of sensory neurons and motor neurons, which may from ganglia and the nervous.
- Ganglia are concentrations of all bodies of neurons.
- The nerves are bundles of exons or dendrites, bounded by connective tissue.
- In humans, there are 12 pairs of cranial or cerebral nerves and 31 pairs of spinal nerves.
- All spinal nerves are mixed nerves.
- The motor neurons from autonomic nervous system which control involuntary responses are divided into the sympathetic and parasympathetic nervous system.
- Sympathetic system is important during emergency situations and is associated with fight or flight and this system accelerates the heartbeat.
- Parasympathetic nervous system works in conditions of rest and rumination or it promotes all internal responses which are associated with relaxed state e.g. it promote digestion of food.

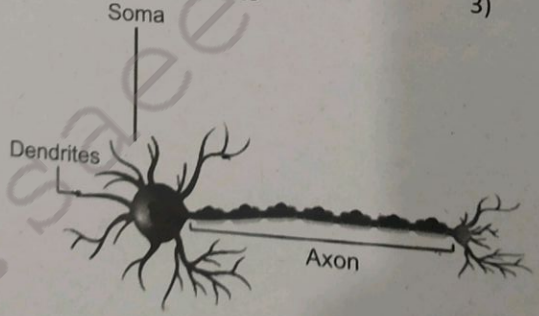
NEURONS

- It is the basic structural and functional unit of nervous system.
- Neurons can generate and conduct nerve impulse which travel across synapses and pass from receptors to effectors, bringing about nervous coordination.
- Neuroglia cells mostly present in higher animals, playing important role in nutrition of neurons and their protection by myelin sheath.
- They constitute nearly half of the nervous system.
- Neurons once matured do not divide any further. However they exhibit limited regenerative capabilities, only if neural cell body is intact.

Structure of Neuron

A typical neuron consists of:

1) Cell body 2) Dendrites 3) Axons.



Cell Body

- Also called soma, is the chief nutritional part of the cell, synthesizes materials necessary for growth and maintenance of neuron.
- It contains nucleus and other cellular organelles, like E.R, ribosomes, G.A, mitochondria embedded in cytoplasm.

- Nissl's granules are group of ribosomes which are present in association with R.E.R and Golgi apparatus.
- If intact, the neuron can regenerate its axonal and dendrites components.

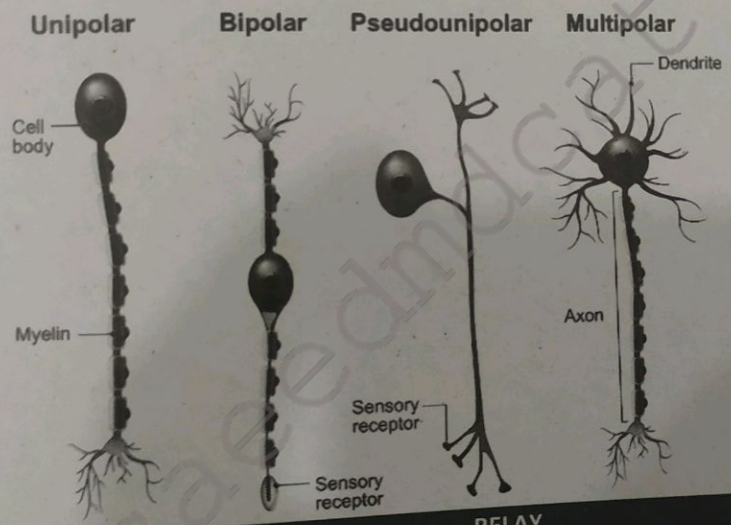
Axons

- The processes carrying impulses away from cell body are called axons.
- Cellular organelles like mitochondria, microtubules and neurofibrils, R.E.R. and G.A are present throughout the axoplasm of the neuron.
- Most of the axons are surrounded by protective sheaths called myelin sheath, important for neuronal nutrition, protection and proper propagation of impulses.

Dendrites

- These are processes that carry impulses towards the cell body. They make synaptic contact with dendrites or axon of neighboring neurons.
- They unlike axon give a spiny look.

Types of Neurons

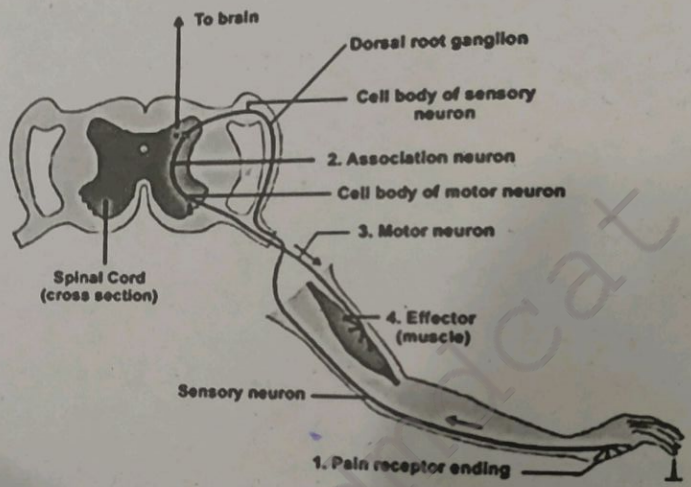


FEATURE	SENSORY	RELAY	MOTOR
Other name	Afferent Neurons	Interneurons	Efferent Neurons
Polarity	Pseudo unipolar	Bipolar	Multipolar
Dendrites	Absent	Absent	True dendrites (short)
Dendron	Present (long)	Present (short)	Absent
Axons	Present (short)	Present (short/long)	Present (long)
Myelination	Always	No	Frequently
Location	**In Spinal Cord:** Axon **Out Spinal Cord:** Dendrites Cell body	Entirely within the spinal cord or CNS	**In Spinal Cord:** Dendrites Cell body **Out Spinal Cord:** Axon
[illegible]	CNS	CNS to CNS	CNS to Effectors

Direction			(muscles)
Occurrence	Receptors such as the eyes, ears, tongue and skin	Brain and spinal cord	Central nervous system (CNS)

Effectors

- These are the structures which respond when they are stimulated by impulse coming via motor neuron.
- The principal effectors are glands, which respond by which respond by secreting; and muscles which respond by contracting. Flow of information through the nervous system is explained with the help of a reflex arc.



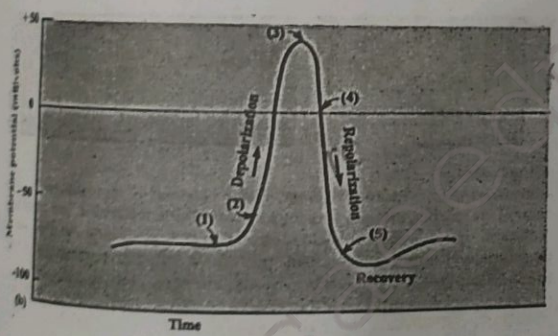
Reflex Arc

- Reflex arc is the path way of passage of impulse during a reflex action. Reflex action is a type of involuntary action.
- **The direction of stimulus is from receptors to sensory neuron to associative (association / relay) neuron and then through motor neuron to the effectors.**

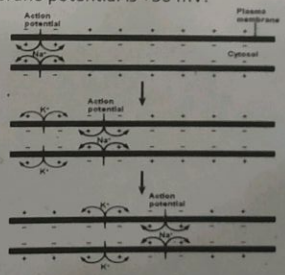
NERVE IMPULSE

- Nerve impulse is a wave of electrochemical changes, which travels along the length of neurons involving movement of ions across the membrane.
- Electrical potential is the measure of the capacity to do electric work.
- The electrical potential that exists across a cell membrane is called membrane potential.
- Potential difference across the membrane when neuron is in non-conducting state is called **resting membrane potential (RMP).**
- A typical neuron at rest is more positive electrically outside than inside the cell membrane.
- Sodium and potassium ions are most important in nerve cell and surrounding fluid.
- Sodium ions are tenfold higher in concentration outside than inside the membrane surface.
- Potassium ions are twenty times more concentrated inside than outside.

- All the neurons have very active sodium and potassium pumps located in their cell membranes. Driven by the splitting of ATP, these pumps transport three Na^+out and two K+ into the cell, against their concentration gradient.
- The large negative organic ions (such as proteins, organic acids etc.) are much more inside the membrane than outside. This makes the inside of neuron membrane more negative.
- The cell membrane is virtually impermeable to all ions except K^+ so some K^+ leak out of the cell. The loss of these positive ions from neuron by diffusion accounts for more negative charges inside than outside.
- **Resting membrane potential is – 70mV.**
- Potential difference across the membrane when neuron is in conducting state is called **active membrane potential (AMP).** During this state, inner membrane surface becomes more positive than outside.
- Under normal conditions, a nerve impulse is initiated by an appropriate stimulus (threshold stimulus) applied at one end of neuron. Minimum intensity of stimulus that is required to initiate a nerve impulse is called **threshold stimulus.**
- It results in a remarkable localized change in the resting membrane potential. It disappears for a brief instant and is replaced by action potential. This change is so brief (for a millisecond) that only a portion of neuron is in active state.
- The passage of nerve impulse is associated with increase in permeability of Na+ ions moving inwards upsetting the potential momentarily, making the inside more positive than outside.
- This increased permeability is due to opening of sodium gates. When these gates open, sodium ions rush into the neuron by diffusion. Some K^+ move out.



- Action membrane potential is +50 mV.



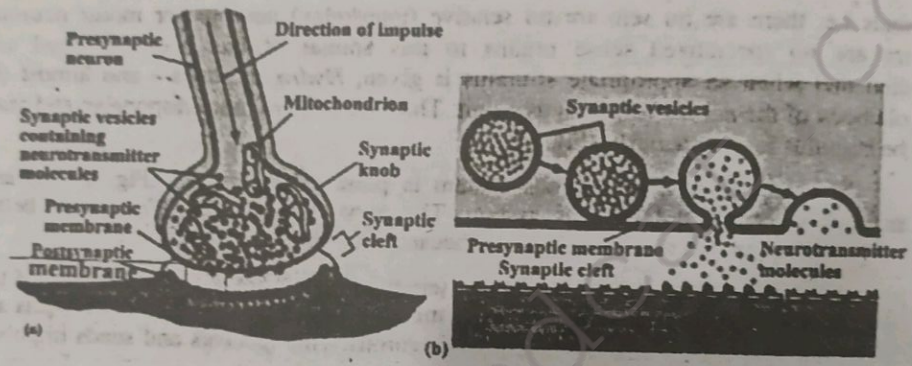
Saltatory Impulse

- **The jumping of nerve impulse from node to node in myelinated nerve ending is called saltatory impulse.**
- **The normal speed of nerve impulse in human is 100 meters per second but maximum speed recorded is 120 meters per second.**

SYNAPSE

- Cytoplasmic gaps between consecutive neurons are called **synapse.**
- A single neuron may form synapses with many incoming fibers of different.
- A single nerve impulse does not necessarily get across the synapse. It may take two or three impulses arriving in rapid succession or perhaps simultaneously from two or more fibers to start an impulse in the next neuron.

- **The action potential cannot jump one neuron to the next in line, rather the message is transmitted across synapse in the form of chemical messenger called neurotransmitters.**
- Neurotransmitters are chemicals, which are released at the axon ending of the neurons at synapse.
- **Acetylcholine is neurotransmitter for synapse outside CNS while adrenalin, nor-epinephrine, serotonin and dopamine in CNS.**
- When an impulse reaches a synaptic knob, synaptic vesicles within fuse with the presynaptic membrane.
- These vesicles cause release of neurotransmitter molecules into the synaptic cleft.
- Neurotransmitter molecules bind to the receptors on post-synaptic membrane, causing changes in its permeability.
- Change in permeability causes initiation of nerve impulse in post-synaptic neuron.



BIOLOGICAL CLOCK & CIRCADIAN RHYTHMS

- In living things, the behavior activities occur at regular intervals which are called **biorhythms or biological rhythms.**
- Biorhythms showing periodicity of about 24 hours are called circadian or **diurnal rhythms**.
- If the biorhythms are of about 365 days, these rhythms in activity are called **circannual rhythms**.
- The organisms come across environmental changes that are cyclical in nature such as days, tides and seasons etc.
- Many organisms maintain internal rhythm or clock to predict onset of the periodic changes and to keep them prepared for these changes.
- Biorhythms may be the result of the following:

1. There may be direct response to various changes in the external (exogenous) stimuli.
2. There may be an internal (endogenous) rhythm that progresses the organisms behaviour in synchronicity with the exogenous temporal period, particularly a 24 hour or a 365 day period.
3. The synchronization mechanism may be a combination of both or 1 and 2.

- The rhythms are in one's genes but the environment influences the rhythms to some extent.
- **Basic period of clock is innate.**

FEATURE	PARKINSON'S DISEASE	EPILEPSY	ALZHEIMER'S DISEASE
Definition	It is a nervous disorder, characterized by involuntary tremors, diminished motor power and rigidity.	It is a convulsive disorder of nerves characterized by abrupt transient symptoms of motor, sensory, psychic or autonomic nature, frequently associated with changes in consciousness.	It is characterized by decline in brain function.
Onset	Late age disease (50's or 60's) & progressive	Before 30 years of age Organic disease after 30 years	Late age disease & progressive
Cause	Cell death in brain area that produces dopamine that may be due to head trauma	No known cause. Emotional disturbance, alcohol etc. are aggravating factors	Genetic predisposition, High levels of aluminum
Treatment	L – dopa, Use GDNF	EEG for diagnosis, Anti-convulsive drugs for therapy	Non – curable

HORMONES

- Hormones are organic compounds of varying structural complexity.
- They are poured directly and are transported to blood to respective target tissues. The hormones affect the target cells.
- **They do not initiate new biochemical reactions but produce their effects by regulating enzymatic and other chemical reactions already present.**
- They may either stimulate or inhibit a reaction.
- **Hormones may also control some long term changes, such as rate of growth, rate of metabolic activity and sexual maturity.**
- Chemically hormones may be of following four types:
  - i). Proteins e.g. insulin and glucagon.
  - ii). Amino acids derivatives e.g. thyroxine, epinephrine, nor –epinephrine
  - iii). Polypeptides e.g. vasopressin/ ADH and oxytocin
  - iv). Steroids e.g. oestrogens, testosterone and cortisone

HYPOTHALAMUS & ITS HORMONES

- It is a part of forebrain.
- It is here that many of the sensory stimuli of nervous system are converted into hormonal responses.
- It is believed that oxytocin and ADH are produced in hypothalamus and travel down the nervous to the posterior lobe of pituitary to be stored.
- They are released from posterior pituitary after receiving nerve impulses from the hypothalamus.

1. **Antiuretic Hormone (ADH)/ Vasopressin**

- Its secretion is caused by decrease in blood pressure, blood volume and osmotic pressure of the blood which is detected by osmoreceptors in hypothalamus.
- External sensory stimuli also influence hypothalamic neurosecretory cells.
- Increased levels cause increased water reabsorption in distal parts of nephron.
- A lack of this hormone produces diabetes insipidus, characterized by production of large quantities of dilute urine and great thirst.

ISLETS OF LANGERHANS

- This is under control of the pituitary trophic hormones. STH and ACTH also respond directly to the level of blood glucose.
- The Islets contain large number of β cells associated with insulin production.
- The small number to α cells secrete glucagon.
- In general, insulin depresses blood glucose levels, in a variety of ways which include increasing glycogen synthesis and increasing utilization of glucose. It also stimulates conversion of glucose into proteins and lipids, which in turn reduce glucose levels.
- Insulin inhibits the hydrolysis of glycogen in the liver and muscles. The symptoms of this are:
  - i). High level of blood sugar
  - ii). Sugar in the urine
  - iii). A disturbance of the body's osmotic equilibrium
  - iv). Derangement of the nervous system
  - v). Toxic metabolites from fat (which need 'glucose energy' for their oxidation) also accumulate and are only lost from the kidney with valuable metal cations.
  - vi). The body becomes dehydrated
- If excess insulin is produced, the utilization of sugar is too great and its level falls in the blood (hypoglycemia) which upsets nerve and muscle functioning.
- Glucagon is essentially antagonistic to insulin and causes an increase in blood glucose levels.
- It does this mainly by promoting breakdown of glycogen to glucose in the liver and muscles.
- It also increases the rate of breakdown of fats.
- Glucagon abnormalities seen rare as endocrine disorders.
- Tumors on the β cells will cause excess glucagon secretions and consequently high blood glucose levels. This in turn damages the α cells.

PLANT HORMONES

Some of the special substances produced by the plants which influence the growth and plant responses to various stimuli are given below.

(a) Auxins: These are indole acetic acid (IAA) or its varients.

- In stem, promote cell enlargement in region behind apex. Promote cell division in cambium.
- In root, promote growth at very low concentrations. Inhibit grow at higher concentrations. E.g. geotropism. Promote growth of roots from cuttings and calluses.
- Promote bud initiation in shoots but sometimes antagonistic to cytokinins and is inhibitory.
- Promote apical dominance and fruit growth. They can sometimes induce parthenocarpy.
- Cause delay in leaf senescence.

- Inhibit abscission.

Commercial applications:

- Discovery of IAA led to the synthesis of wide range of compounds by chemists. The synthetic auxins are economical than IAA to produce and often more active because plants generally do not have necessary enzymes to break them down.

Synthetic Auxins	
NAA (Naphthalene acetic acid) Indole propionic acid	Stimulates fruiting – help natural fruit set. Sometimes causes fruit setting in absence of pollination (parthenocarpy).
2,4 D (2,4 Dichloro phenoxy acetic acid)	Selective weed killer: Kills broad leaved species(dicots). Used in cereal crops and lawns to eliminate weeds. Inhibits sprouting of potatoes. Prevents premature fruit drop (retards abscission).

(b) Gibberellins: These are produced commercially from fungal cultures.

- Promote cell enlargement in the presence of auxins. Also promote cell division in apical meristem and cambium.
- Promote 'bolting' of some rosette plants.
- Promote bud initiation in shoots of chrysanthemum callus.
- Promote leaf growth and fruit growth. May induce parthenocarpy.
- In apical dominance, enhance action of auxins.
- Break bud and seed dormancy.
- Sometimes may substitute for red light. Therefore, promote flowering in long – day plants, while inhibit in leaf senescence in a few species.
- Cause delay in leaf senescence in a few species.

Commercial applications

1. **GA promote fruit setting e.g. in tangerines and pears and are used for growing seedless grapes (parthenocarpy) and also increate the berry size.**
2. **GA_3 is used in the brewing industry to stimulate α - amylase production in barley and this promotes malting.**
3. To delay ripening and improve storage life of bananas and grape fruits.

(C) Abscisic acid:

- **Inhibits stem and root growth notable during physiological stress, e.g. drought, and waterlogging.**
- Promotes bud and seed dormancy.
- Promotes flowering in short day plants, and inhibits in long day plants **(antagonistic to gibberellins).**
- Sometimes promotes leaf senescence.
- Promotes abscission.
- **Promotes closing of stomata under conditions of water stress (wilting).**

Commercial application

- Abscisic can be sprayed on tree crops to regulate fruit drop at the end of season.
- This removes the need for picking over a large time span.

MCQ's OF COMMUNICATION

1. **Ganglion is present in**
   A) CNS B) Outside PNS C) Outside CNS D) Bones
2. **The sensations from joints are detected by which receptors:**
   A) Photoreceptors B) Chemoreceptor C) Thermoreceptors D) Proprioreceptors
3. **Myelin sheath in central nervous system is formed from cells:**
   A) Schwann cells B) Soma C) Both D) Dendrites and axons
4. **In myelinated nerves fibers, impulse jumps from node to node called:**
   A) Saltatory conduction C) Electric impulse
   B) Ion tropic movement D) None
5. **Which type of neuron has long dendron:**
   A) Sensory B) Motor C) Intermediate D) All
6. **Depolarization is caused by:**
   A) K^+ influx B) Na^+ influx C) Na^+ efflux D) All of these
7. **At ATPase Na^+-k^+ pump the no. of binding sites for Na^+**
   A) 1 B) 2 C) 3 D) 4
8. **Under resting condition inner part of cell membrane of neuron is:**
   A) -vely charged B) +vely charged C) Neutral D) Variable
9. **Maximum speed of nerve impulse in humans is:**
   A) 100 m/sec B) 120 cm/sec C) 100 cm/sec D) 120 m/sec
10. **A nerve impulse is passed from one to other neuron in synapse?**
    A) Jumping movements C) Hormones
    B) Neurotransmitters D) All
11. **Main neurotransmitter for peripheral synapsis is:**
    A) Acetylcholine B) Dopamine C) Serotonin D) All
12. **Two cerebral hemispheres communicate with each other by:**
    A) Infundibulum B) Stalk C) Corpus callosum D) Corpus cavernosum
13. **Menstrual cycle in females is under control of:**
    A) Limbic system B) Hypothalamus C) Pituitary D) Cerebrum
14. **Reticular formation is the characteristic of:**
    A) Midbrain B) Fore brain C) Hind brain D) Pons
15. **Grey matter is composed of:**
    A) Cell bodies C) Both
    B) Non-myelinated nerve fibers D) Myelin
16. **Which is function of cerebral cortex:**
    A) Intelligence B) Reasoning C) Judgment D) All
17. **The number of cranial nerves are:**
    A) 42 B) 24 C) 36 D) 12
18. **Most ganglionic fibers of sympathetic N.S arise from:**
    A) Ends of spinal cord C) Brain
    B) mid of spinal cord D) All
19. **The size of pupil is decreased by which nervous system part:**
    A) Sympathetic B) Parasympathetic C) Paratonic D) Somatic
20. **The symptoms of epilepsy may be of which type:**

A) Sensory B) Motor C) Psychic D) All

21. **Which of the following statements is true?**
A) Salutatory conduction is seen in non-myelinated nerve fibres
B) Nissl's granules are found in muscles fibres
C) Non-myelinated nerve fibres do not possess nodes of Ranvier
D) Non-myelinated nerve fibres are completely enclosed by myelin sheath

22. **In which organisms is a nerve impulse least likely to travel in a definite pathway?**
A) Hydra B) Earthworm C) Planaria D) Human

23. **Cell bodies of sensory neurons constitute:**
A) Dorsal root ganglion
B) Dorsal root
C) Ventral root ganglion
D) Posterior root ganglion

24. **Which of the following is common to all neurons?**
A) A cell body which contains a nucleus
B) A thick myelin sheath
C) Presence of nodes of Ranvier
D) Presence of Schwann cells

25. **A nerve impulse is a wave of electrochemical change travelling along the length of the neuron involving chemical reactions and movement of ions across the:**
A) Synapse B) Cell wall C) Cell membrane D) Axon

26. **Repolarization occurs when:**
A) Na^+ moves outside axon
B) Na^+ moves inside axon
C) K^+ moves outside axon
D) K^+ moves inside axon

27. **Which is a part of spinal cord?**
A) Central canal
B) Ventral canal
C) Ventricle
D) Enterocoel

28. **What happens when the voltage reaches to +35 mv?**
A) Na^+ gates close and K^+ gates open
B) Na^+ gates open and K^+ gates close
C) Both Na^+ gates and K^+ gates open
D) Both Na^+ gates and K^+ gates close

29. **Nerve cells do not divide because they do not have:**
A) Nucleus
B) Centrosome
C) Golgi body
D) Mitochondria

30. **The movement of the nerve impulse across synaptic cleft is primarily?**
A) A chemical event
B) A physical event
C) A electrical event
D) A biological event

31. **A person having parkinson's disease shows defective action of which neutrotransmitter in brain:**
A) Dopamine
B) Noradrenaline
C) Serotonin
D) Eukalphia

32. **In central nervous system are found:**
A) Motor and sensory neurons
B) Motor and intermediate neurons
C) Intermediate and secondary neurons
D) Only intermediate neurons

33. **Cerebellum of brain is concerned with:**
A) Balancing during sitting
B) Coordination of muscular movements
C) Balancing during active movement
D) Initiation of muscular contraction

34. **Onset of epilepsy is usually before age of**
A) 40 B) 50 C) 30 D) 45

35. **If medulla oblongata is destroyed then which of the following functions will be effected?**
A) No thermoregulation
C) No memory

B) No vision
D) No response when pricked with needle

36. **Cerebral hemispheres of rat are connected by:**
A) Corpus luteum
B) Corpus callosum
C) Corpus albicans
D) Corpus spongiosum

37. **Node of Ranviers are:**
A) Exposed regions of axon
B) Insulated regions of axon
C) Terminal knobs at the end of axon
D) Schwann cells present at equal distances

38. **Nissl granules occur in which part and what is their function:**
A) Neurons and help in nutrition and excretion
B) Blood and help in nutrition and excretion
C) Sarcoplasm and help in contraction
D) Mucous cells and secrete mucus

39. **Neurotransmitter molecule binds to receptors that are located on:**
A) Post synaptic membrane
B) Synaptic knob
C) Pre synaptic membrane
D) Synaptic cavity

40. **Axon is long in:**
A) Sensory neuron B) Associative neuron C) Motor neuron D) None of these

Answers:

1.	C	2.	D	3.	A	4.	A	5.	B	6.	B	7.	C	8.	A	9.	D	10.	B
11.	A	12.	C	13.	B	14.	A	15.	C	16.	D	17.	B	18.	B	19.	B	20.	D
21.	C	22.	A	23.	A	24.	A	25.	C	26.	D	27.	A	28.	A	29.	B	30.	A
31	A	32	B	33	C	34	C	35	D	36	B	37	A	38	A	39	A	40	C

ASSESS YOURSELF

(COMMUNICATION)

1. **Which of the following increases when an action potential is initiated?**
   A) Diffusion of sodium ions into neuron
   B) Diffusion of sodium ion out of neuron
   C) Diffusion of potassium ion out of neuron
   D) Diffusion of potassium ion into neuron
2. **Medulla, pons and cerebellum are parts of:**
   A) Fore brain B) Mid Brain C) Hind brain D) Limbic system
3. **It is important in coordinating the movements of the body:**
   A) Cerebrum B) Medulla C) Pons D) Cerebellum
4. **Salutatory transmission occurs in:**
   A) Non myelinated nerve fiber C) Analogue pattern
   B) Myelinated nerve fiber D) Continuous fashion
5. **Neuroglia makes up as much as half of:**
   A) Muscular system C) Glandular system
   B) Nervous system D) Skeletal system
6. **Motor neurons have:**
   A) Short axon B) Long axon C) Long dendrites S D) Short dendrites
7. **The single fibre which carries impulse towards cell body is called:**
   A) Dendrite B) Axon C) Cell body D) Dendron
8. **In action potential depolarization, repolarization and recovery takes _____ time?**
   A) 2-3 seconds B) 2-3 minutes C) 2-3 milliseconds D) 2-3 microseconds
9. **Other names for associative neurons are:**
   A) Association neurons C) Intermediate neurons
   B) Relay neurons D) Association, inter and relay neurons all
10. **The division of ANS that produces largely involuntary responses related to the normal body function, such as digestion:**
    A) ANS C) Parasympathetic division
    B) PNS D) Sympathetic division
11. **The part of the hind brain of vertebrates that controls automatic activities such as breathing, swallowing, heart rate and blood pressure:**
    A) Pons C) Cerebellum
    B) Medulla oblongata D) Reticular formation
12. **The net difference of charges between the inner and the outer surface of a non-conducting neuron is called:**
    A) Membrane potential C) Active membrane potential
    B) Resting membrane potential D) Electrical potential
13. **In the living things the behavior activities occur at regular intervals which are called:**
    A) Diurnal rhythms C) Biological rhythms
    B) Circannual rhythms D) Lunar rhythms
14. **It is considered one out of three parts of fore brain and is further sub divided into three parts:**
    A) Thalamus C) Limbic system
    B) Hypothalamus D) Cerebrum
15. **Microscopic gaps between the neuron endings are called**

B
D
A
C

A) Transmitters B) Pores C) Synapses D) Nodes

16. In which of the following neurons length of dendrite is greater than axon?

A) Sensory neuron
B) Associative neuron
C)Motor neuron
D) None of these.

17. Ervin Bunning of the University of Tubingen, Germany, has kept the Drosophila in constant conditions for:

A) Twelve generations
B) Thirteen generations
C) Fourteen generations
D) Fifteen generations

18. Perching behavior in birds is due to advanced:

A) Cerebrum
B) Cerebellum
C) Hypothalamus
D) Medulla oblongata

19. It is characterized by decline in brain functions:

A) Alzheimer's disease
B) Epilepsy disease
C) Parkinson's disease
D) Anorexia nervosa

20. The part of neuron which is already in resting potential is also considered to be in:

A) Polarized state
B) Depolarized stated
C) Repolarized
D) Recovery state

21. What is the function of synapse?

A) To allow nerve impulse to move in backward direction
B) To decrease the speed of nerve impulse
C) To stop the nerve impulse
D) To provide cytoplasmic connection between neurons.

22. The most important ions present in the neurons and surrounding fluids are:

A) Sodium and calcium
B) Sodium and Potassium
C) Calcium and Potassium
D) Negative organic ions

23. Sodium ions are _____ folds higher in concentration outside than inside the membrane surface of nerve cell:

A) Three B) Five C) Seven D) Ten

24. It is one of the convulsive disorders of nerves:

A) Alzheimer's disease
B) Parkinson's disease
C) Dementia disease
D) Epilepsy disease

25. Reflex actions below the neck are under control of

A) Brain B) Hypothalamus C) Spinal cord D) none of these.

26. The concentration of potassium ions inside the membrane of nerve cell than outside is:

A) Ten times more
B) Twenty times more
C) Fifteen times more
D) Twenty five times more

27. There is no cytoplasmic connection between two neurons and microscopic gaps are left between them which are called:

A) Synapsis B) Synapse C) Nodes of Ranviers D) Interstitial gaps

28. Which of the followings is missing from the nervous system of planaria?

A) Ganglia
B) Lateral nerves
C) Longitudinal nerves
D) None of these.

29. In neurons the sodium-potassium pump actively transport:

A) Na^+ in and K^+ out of the cell
B) Cl^- in and K^+ out of the cell
C) Na^+ out and K^+ out of the cell

30. Main neurotransmitter for synapses that lie outside the central nervous system is called:
A) Acetylcholine B) Serotonin C) Dopamine D) Adrenaline

31. Nicotine affects post synaptic membrane in:
A) CNS B) PNS C) CNS and PNS both D) Brain and spinal cord

32. Intelligence is under the control of
A) Cerebrum B) Thalamus C) Cerebellum D) Hypothalamus

33. Biorhythms may be the result of the following (s):
A) Exogenous (external stimuli)
B) Synchronization of internal and external stimuli
C) Endogenous (internal stimuli)
D) External & internal stimuli and synchronization of both

34. Nicotine increases the following, EXCEPT:
A) Heart beat rate C) Blood pressure
B) Sugar level in blood D) Digestive tract mobility

35. Diffused nervous system is present in:
A) Hydra B) Planaria C) Earthworm D) Ascaris

36. The thalamus is a crucial relay center among the senses, the limbic system, and the:
A) Cerebral cortex B) Adrenal cortex C) Cerebellum D) Thalamus

37. Which of the following feature is not related to neuron
A) Conduction B) Reflex C) Regeneration D) Movement

38. Which one of the following is a naturally occurring growth inhibitor?
A) IAA C) ABA
B) NAA D) GA

39. Hormone responsible for senescence
A) ABA C) Auxin
B) GA D) Cytokinin

40. Following are the functions of insulin except
A) Glycogenesis C) ↑ Glucose utilization by adipocyte
B) ↑ Glucose utilization by hepatocyte D) Gluconeogenesis

CHAPTER 12

REPRODUCTION

COURSE CONTENT

Explain the reproductive system in male in detail

Explain the reproductive system in female / Menstrual cycle

Explain:

Spermatogenesis

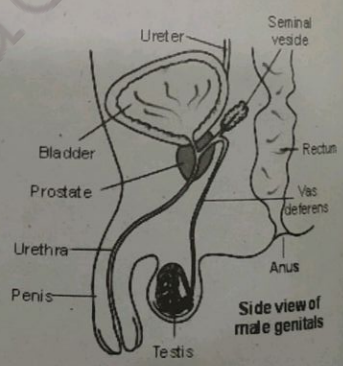
Oogenesis

Discuss the following Diseases in detail which are sexually transmitted:

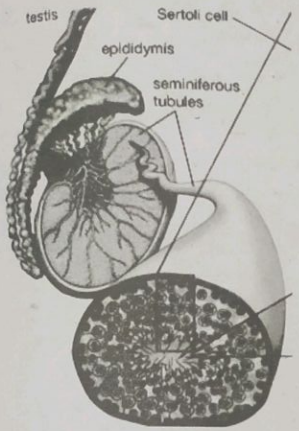
Gonorrhea, Syphilis, Genital herpes, AIDS and how these diseases can be controlled (Treatment is not required)

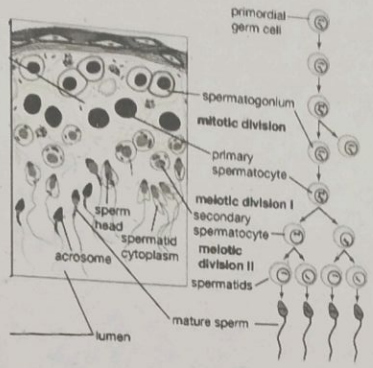
MALE REPRODUCTIVE SYSTEM

- Male gonads consist of a ***pair of testes***, which lie outside the body, in sac-like scrotum.
- ***Penis*** is external genitalia, which is used to transfer sperm into female reproductive tract.
- ***Sertoli cells***, which provide liquid medium, protection and nourishment to cells while they are in the tubules.
- Interstitial cells are present between the seminiferous tubules and secrete testosterone essential for production of sperms and development of male secondary sexual characteristics during puberty.



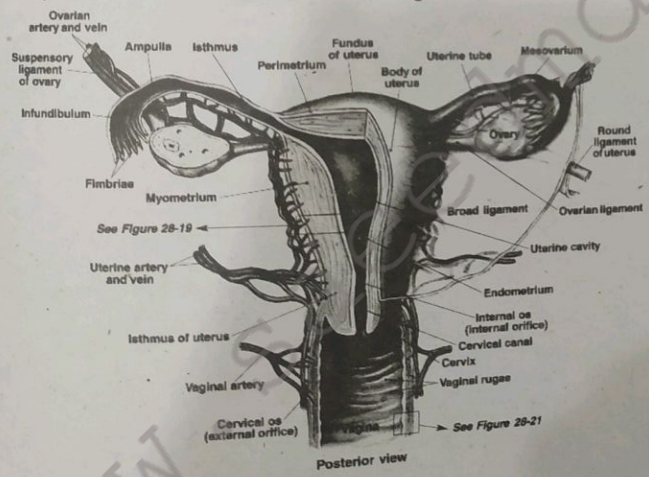
Side view of male genitals





FEMALE REPRODUCTIVE SYSTEM

- ***Vagina*** is external genitalia in female.
- Discharge of ovum from ovary is called ***ovulation***.
- Fertilization of ovum occurs in ***proximal part of oviduct***.
- Oestrous cycle is reproductive cycle in all females' mammals except humans. At this stage female is on heat i.e. exhibits the desire for mating.



MENSTRUAL CYCLE

- In human female, ***menstrual cycle*** of 28 days occur involving structural and functional changes.
- ***Events of menstrual cycle*** involve the ovaries (ovarian cycle) and uterus (uterine cycle).
- Process by which other follicles degenerate is called ***follicle atresia***.
- Follicle cells after ovulation convert into yellowish glandular ***corpus luteum*** which secretes progesterone.
- ***Leutrnizing hormone*** causes ovulation.

- The end or complete stop of menstrual cycle is called ***menopause***.
- ***Menstruation stage*** lasts for 3-7 days.

MALE AND FEMALE REPRODUCTIVE SYSTEM

FEATURE	MALE REPRODUCTIVE SYSTEM	FEMALE REPRODUCTIVE SYSTEM
Gonads	Pair of testes	Pair of ovaries
External Genitilia	Pair of testes , scrotum and copulatory organ.	Vagina
Duct System	Seminiferous tubules ,Epididymis ,Vas deferens and Urethra	Oviduct Uterus Vagina
	SPERMATOGENESIS 1....Spermatogonium (2n) ↓ **Mitosis** ↓ 1....Primary Spermatocyte (2n) ↓ **Meiosis-1** ↓ 2...Secondary Spermatocyte (n) ↓ Meiosis-II ↓ 4....Spermatid (n) ↓ 4....Sperm (n)	OOGENESIS 1....Oogonium (2n) ↓ **Mitosis** ↓ 1....Oogonia (2n) ↓ **Cell Growth** ↓ 1....Primary Oocyte (2n) ↓ **Meiosis-I** ↓ 1...Secondary Oocyte(n) — 1...First Polar Body (n) ↓ **Meiosis-II** ↓ ↓ 1...Ovum (n) — 1...Second Polar Body (n)

IDENTICAL & FRATERNAL TWINS

FEATURE	IDENTICAL TWINS	FRATERNAL TWINS
Genetic Make up	Identical	Different
Cell Division	Mitotically (Asexually)	Sexually
Production	Separation of blasotomeres at two cell stages	Formation of two different zygotes

SEXUALLY TRANSMITTED DISEASES

- ***Gonorrhoea*** is caused by gram positive Bacterium *Neisseria gonorrhoeae* and affects mucous membranes of urinogenital tract.
- ***Syphilis*** is caused by spirochete *Treponema pallidum*, which damages reproductive organs, eyes, bones, joints, CNS, heart and skin.
- ***Genital herpes*** is caused by herpes simplex type II virus and produces genital soreness and ulcers in the infected areas. If this virus is transmitted to infant during birth, it may cause damage to eyes and CNS.

Feature	Gonorrhea	Syphilis	Genital Herpes	AIDS
Casual agent	Gram positive bacteria	Spirochete	Virus	Virus
Cause	Neisseria gonorrhea	Treponema pallidum	Herpes simplex type II	HIV
Main parts affected	Mucous membrane of urinogenital tract, eye infection to baby	Damage to reproductive organs, eyes, bones, joints, CNS, heart, skin.	Infection of genitilia, genital soreness & ulcers, damage to eyes & CNS in infants.	Destruction of immune system
Source of transmission	Sexual contact	Sexual contact	Sexual contact	Sexual contact

MCQs OF REPRODUCTION

1. **Syphilis caused by:**
   A) Treponema pallidum
   B) Neisseria gonorrhea
   C) Herpes virus type II
   D) None of these
2. **Human are:**
   A) Craniates B) Amniotes C) Tetrapods D) All of these
3. **Menstrual cycle begins:**
   A) At the end of menstruation
   B) At the beginning of menstruation
   C) At the mid of menstruations
   D) At proliferation
4. **Which are gonadotrophins:**
   A) FSH and LH
   B) Progesterone and oestrogen
   C) Androgens and testosterone
   D) Inhibin and androgen
5. **What is meant by 'fertilized egg getting conceived':**
   A) Aborted B) Removed C) Moved to uterus D) Implanted
6. **Secondary oocyte is:**
   A) Diploid
   B) Haploid
   C) Product of meiosis II
   D) Both A & C
7. **FSH is produced:**
   A) Only in males
   B) Only in females
   C) In both males and females
   D) Helps only in spermatogenesis
8. **Which can affect female reproductive cycle:**
   A) Malnutrition
   B) Emotional stresses
   C) Hormones
   D) All of these
9. **Which duct is urinogenital:**
   A) Vas deferens B) Ureter C) Ejaculatory D) Urethra
10. **Which structure is found in female:**
    A) Vas deferens B) Vagina C) Ejaculatory D) Urethra
11. **Vagina:**
    A) Has a single opening
    B) Two openings
    C) 3 openings
    D) None of these
12. **Which acts as birth canal:**
    A) Uterus B) Oviduct C) Vagina D) Ovary
13. **Top skin of penis is called:**
    A) Didymis B) Prepuce C) Erectile part D) Scrotum
14. **Number of sperm ducts in males:**
    A) 1 B) 2 C) 3 D) 4
15. **Which helps in secretion of LH:**
    A) Ovulation
    B) Decrease in FSH
    C) Increase in oestrogen
    D) Both B & C
16. **Desire to mate in mammal females at the time of ovulation is referred to as:**
    A) Oestrous B) Menstruation C) Heat D) Both A & C
17. **Internal linings of uterus are called:**
    A) Myometrium B) Perimetrium C) Endometrium D) None of these
18. **Which is single in cryptorchidism**

A) Kidney B) Testes C) Brain D) Legs

19. **Triplet means:**
A) One baby B) Two baby C) Three baby D) Four baby

20. **Process of birth is initiated by**
A) Foetus B) Mother C) Environment D) All of these

21. **In a developing foetus, most of the major organ systems are developed by the end of _____ weeks:**
A) 14 B) 12 C) 10 D) 16

22. **The release of ovum from ovary is known as:**
A) Ovulation B) Parturition C) Oogenesis D) Gametogenesis

23. **Total number of polar bodies formed in oogenesis?**
A) 2 B) 3 C) 1 D) 0

24. **The first menstruation which begins at puberty is called:**
A) Menstrual cycle B) Oogenesis C) Menarche D) Ovulation

25. **It is a glandular structure only present in male:**
A) Prostate gland B) Placenta C) Pituitary gland D) Pineal gland

26. **Estrogen is produced by the ovary under the stimulus of:**
A) LH B) FSH C) LTH D) ICSH

27. **Which statement is incorrect?**
A) Syphilis is caused by Treponema pallidum
B) Syphilis affects eyes, bones, joints, CNS
C) Genital herpes produces genital soreness and ulcers
D) Gonorrhea is caused by gram negative bacterium

28. **Which is not viral disease?**
A) Syphilis B) Gonorrhea C) Both D) Genital herpes

29. **Testis lie in scrotal sacs in order to**
A) Prevent physical injury C) Secrete hormones
B) Lower their temperature D) Prevent dehydration

30. **It is not the part of human female reproductive system:**
A) Ovaries B) Oviducts C) Uterus D) Ureter

31. **Large amounts of progesterone is secreted by:**
A) Corpus germinativum C) Corpus luteum
B) Corpus cavernosa D) Corpus pellucida

32. **The stage in human female when menstrual cycle ceases at the age of 50 is known as:**
A) Ovopause B) Menopause C) Menarche D) Menstruation

33. **It is the result of mitosis:**
A) Germinal epithelium → Spermatogonia C) Primary spermatocytes → Spermatids
B) Spermatids → sperms D) Spermatids → Spermatozoa

34. **Uterus is commonly known as:**
A) Birth canal C) Womb
B) Primary female sex organ D) Female external genitalia

35. **It is paired gland situated on the either sider of prostate gland behind urinary bladder:**
A) Seminal vesicle C) Cowper's gland
B) Bulbourethral gland D) Adrenal gland

6. **The correct sequence of spermatogenetic stages leading to the formation of sperms in a mature human testis is:**
   A) Spermatogonia-Spermatid-Spermatocyte-Sperms
   B) Spermatocyte-Spermatogonia-Spermatid-Sperms
   C) Spermatogonia-Spermatocyte-Spermatid- -Sperms
   D) Spermatid-Spermatocyte-Spermatogonia-Sperms

7. **The function of vas deferens is to:**
   A) Produce the sperms
   B) Mature the sperms
   C) Store the sperms
   D) Transfer the sperms

8. **The number of spermatids formed from four secondary spermatocytes are:**
   A) 4 B) 16 C) 8 D) 32

9. **The structure which receives ovulated oocyte and the site where generally fertilization occur:**
   A) Fallopian tube
   B) Uterine tube
   C) Proximal part of oviduct
   D) Proximal part of oviduct, uterine tube & fallopian tube

0. **Which of the following STD is caused by obligative intracellular parasite?**
   A) Gonorrhoa B) Genital herpes C) Syphilis D) Genital herpes, AIDS

nswers:

1.	A	2.	B	3.	B	4.	A	5.	D	6.	B	7.	C	8.	D	9.	D	10.	B
11.	A	12.	C	13.	B	14.	B	15.	D	16.	C	17.	C	18.	B	19.	C	20.	A
21.	B	22.	A	23.	B	24.	C	25.	A	26.	B	27.	D	28.	C	29.	B	30.	D
31	C	32	B	33	A	34	C	35	A	36	C	37	D	38	C	39	D	40	D

1. **Type of cells inhuman testes which produce testosterone is called:**
   A) Interstitial cells
   B) Germ cells
   C) Sertoli cells
   D) Spermatocytes
2. **Breakdown of endometrium during menstruation is due to :**
   A) Increase in level of LH
   B) Decrease in level of
   C) Increase in level of progesterone
   D) Increase in level of estrogen progesterone
3. **Oogonia are produced in germ cells of**
   A) Both uterus and cervix
   B) Cervix
   C) Uterus
   D) Ovary
4. **Leuteinizing hormone triggers:**
   A) Cessation of oogenesis
   B) Breakdown of oocytes
   C) Ovulation
   D) Development of zygote
5. **Syphilis is a sexually transmitted disease which is caused by :**
   A) HIV / AIDS
   B) Pseudomonas pyogenes
   C) Treponema palladium
   D) Neisseria
6. **Syphilis is sexually transmitted disease which is caused by :**
   A) Neisseria gonorrhea
   B) E.coli
   C) Treponema pallidum
   D) Mycobacterium ovum
7. **Discharge of ovum, or secondary oocyte from ovary is called:**
   A) Fertilization
   B) Pollination
   C) Follicle formation
   D) Ovulation
8. **Second meiotic division in the secondary oocyte proceeds as far as :**
   A) Metaphase
   B) Prophase
   C) Anaphase
   D) Telophase
9. **Which one of the following differentiates directly into mature sperm ?**
   A) Primary spermatocyte
   B) Secondary spermatocyte
   C) Spermatogonia
   D) Spermatid
10. **Uterus opens into vagina through:**
    A) Cervix
    B) Fallopian tube
    C) External genitellia
    D) Vulva
11. **Spermatogonia differentiate directly into ?**
    A) Primary spermatocytes
    B) Secondary spermatocytes
    C) Spermatozoa
    D) Spermatids
12. **Treponema palladium causes ?**
    A)AIDS
    B) Genital herpes
    C) Syphilis
    D) Gonorrhea
13. **What is the location of interstitial cells in testes ?**
    A) Inside the seminiferous tubules
    B) Between the seminiferous tubules
    C) Among the germinal epithelial cells
    D) Around the testes
14. **A type of cells in human testes which produce testosterone are called ?**
    A) Germ cells
    B) sertoli cells
    C) Interstitial cells
    D) Spermatocytes
15. **The hormone produced from corpus luteum is ?**

A) Prolactin B) FSH C) Progesterone D) LH

16. **It is a joint:**
A) Urinary bladder
B) Urethra
C) Symphysis pubis
D) Seminal vesicles

17. **Causative agent of a sexually transmitted disease that affects mucous membrane of the urinogenital tract is:**
A) Staphylococcus aureus
B) Treponema pallidum
C) Neisseria gonorrhoeae
D) Escherichia coli

18. **This stimulus causes ovulation in female during estrous cycle:**
A) Hormonal B) Physical C) Estrogen D) Progesterone

19. **Main duct of the male reproductive tract is:**
A) Sperm duct B) Ejaculatory duct C) Vas deferens D) Urethra

20. **The sperms are discharged out through:**
A) Urinogenital duct B) Ejaculatory duct C) Sperm duct D) Vas deferens

21. **Treponema palladium causes?**
A) AIDS B) Genital herpes C) Syphilis D) Gonorrhea

22. **Oogonia are produced in the germ cells**
A) Both Uterus and Cervix
B) Cervix
C) Uterus
D) Ovary

23. **What is the location of interstitial cells in testes?**
A) Inside the seminiferous tubules
B) Between the seminiferous tubules
C) Among the germinal epithelial cells
D) Around the testes

24. **Oogonia divide mitotically to form:**
A) Secondary oocytes
B) Primary oocytes
C) Infinite oogonia
D) Few oogonia

25. **These are enclosed in a group of follicle cells:**
A) Oogonia
B) Primary oocytes
C) Secondary oocytes
D) Ova

26. **Production of gametes is a cyclic activity in:**
A) Human male B) Vertebrates C) Human female D) Mammals

27. **The events of the _____ involve the ovarian cycle and the uterine cycle:**
A) Life cycle B) Menstrual cycle C) Oestrous cycle D) Uterine cycle

28. **Luteinizing hormone triggers**
A) Cessation of Oogenesis
B) Breakdown of Oocyte
C) Ovulation
D) Development of Zygote

29. **Vas deferens forms highly convoluted:**
A) Sperm duct B) Epididymis C) Ejaculatory duct D) Urethra

30. **_____ the uterine and ovarian cycles compare, it is possible to determine, when:**
A) Ovarian is more likely to occur
B) Child birth is more likely to occur
C) Menstruation is more likely to occur
D) Pregnancy is more likely to occur

31. **In human female, periodic reproductive cycle is completed in approximately:**
A) 30 days B) 27 days C) 28 days D) 29 days

32. **For the formation of 32 spermatids and 16 ova the number of meiosis required is**
A) 4 and 16 B) 4 and 8 C) 8 and 16 D) 32 and 16

33. **Breakdown of endometrium during menstruation is due to**

A) Increase in Level of LH
B) Decrease in Level of Progesterone
C) Increase in Level of Progesterone
D) Increase in Level of Oestrogen

34. **If the reproductive cycle is not being completed in its normal 28 days, it means female is:**
A) Malnourished
B) Emotionally disturbed
C) Malnourished or/and emotionally disturbed
D) Sterile

35. **In human female ovulation occurs during menstrual cycle**
A) At the end of proliferative phase
B) At the beginning of proliferative phase
C) Before the end of secretary phase
D) In the middle of secretary phase

36. **The carriers may transmit such diseases to their healthy partners:**
A) Organic diseases
B) Genetic diseases
C) Sexually transmitted diseases
D) Congenital diseases

37. **The outermost layer of newly ovulated ovum is:**
A) Zona pellucida
B) Corona radiata
C) Chorioallantois
D) Amnion

38. **In events of ovarian cycle, ovulation occurs before:**
A) Maturation of follicle
B) Formation of early corpus luteum
C) Regression of corpus luteum
D) Development of follicle

39. **Enlarged lining epithelial cells connected with groups of developing spermatozoa in testes are:**
A) Sertoli cells
B) Spermoblasts
C) Somatic cells
D) Sertoli cells/Spermoblast

40. **The cells present towards the centre of the lumen of seminiferous tubules are:**
A) Motile and diploid
B) Motile and haploid
C) Non-motile and diploid
D) Non-motile and haploid

CHAPTER 13

GENETICS, CHROMOSOMES AND DNA & CELL CYCLE

COURSE CONTENT

- Basics of Genetics: Gene, Locus, Allele, Gene Pool, Phenotype, Genotype, Homozygous, Heterozygous, Dominant Allele, Recessive Allele, Complete Dominance, Dominance, Linkage, F1 & F2 Generations, Mutation and Multiple Allele.
- Gene Linkage: Crossing over and Recombination Frequency / Cross Over Value
- Continuous and Discontinuous Variations
- Punnet square, Test cross and Monohybrid & Monohybrid & Dihybrid Crosses
- Gene Linkage and Sex Linkage in Human (Human (Haemophilia and Colour Blindness).

Genetics

"Branch of Biology deals with the study of genes and their role in inheritance"

A) DEFINITIONS

GENE

Gene is the basic unit of biological information. The position of a gene on the chromosome is called locus.

ALLELE

Partners of a gene pair are called allele. Each allele of a gene pair occupies the same gene locus on its respective homologus.

MULTIPLE ALLELES

Alternative from of a gene, whose number is more than two, are called multiple alleles. They are produced as a result of gene mutation.

LOCUS:

Position of gene on chromosome.

PHENOTYPE:

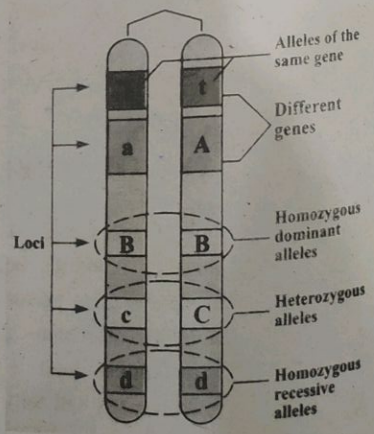
Physical appearance of a trait is called phenotype.

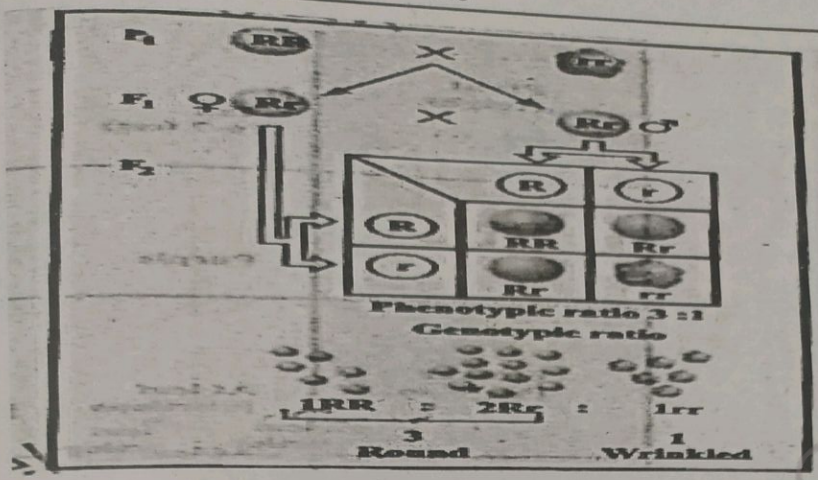
GENOTYPE:

Genetic combination of a trait is called genotype.

Law of Segregation:

According to law of segregation, the two coexisting alleles for each trait in an individuals segregation (separate) from each other at meiosis, so that each gamete receives only one of the two alleles. Alleles units again at random fertilization of gametes when zygote is formed.

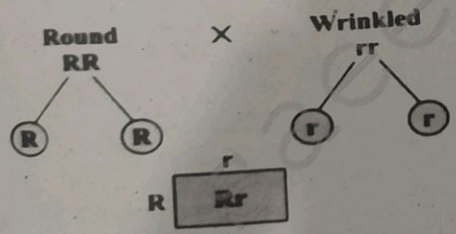
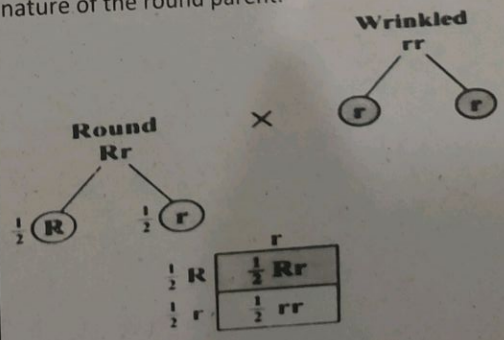


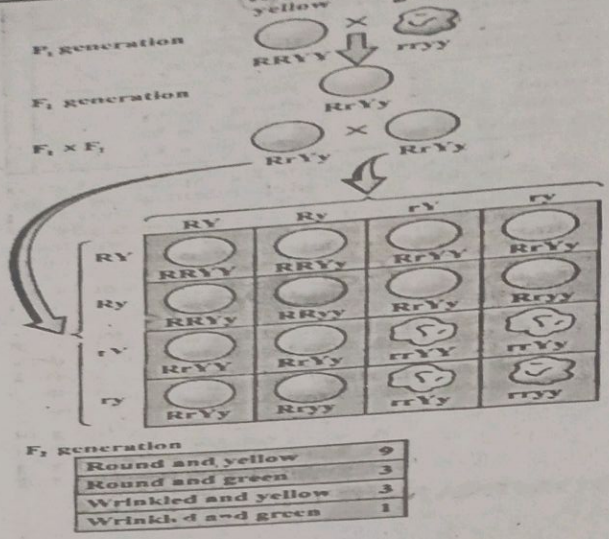


Test Cross

Mendel devised a cross called test cross, which is used to test the genotype of an individual showing a dominant phenotype. It is a mating in which an individuals showing a dominant phenotype is crossed whit an individual showing its recessive phenotype. This cross finds out the homozygous nature of the genotype.

A phenotypically round seed could be homozygous (RR) or heterozygous(Rr).

Case I	Case II
If the seed is homozygous round (RR) it will grow into a pea plant that forms all gametes with only 'R' allele. Wrinkled seed plant is always homozygous recessive. It will form all gametes with 'r' allele. Fertilization will result in 100% round seed progeny.	If the seed is heterozygous round (Rr), it will grow into a plant that forms half the gametes with 'R' and half with 'r' allele. Wrinkled seed plant will form only 'r' type of gametes. Fertilization will result into 50% round and 50% wrinkled seed progeny. Even a single wrinkled seed in the progeny is a convincing proof for heterozygous nature of the round parent.
	
Result: All round seed progeny. The tested phenotypically dominant individual is homozygous.	**Result:** ½ round seed and ½ wrinkled seed progeny. The tested phenotypically dominant individual is heterozygous.



Mendel formulated Law of Independent Assortment: **"When two contrasting pairs of traits are followed in the same cross, their alleles assort independently into gametes".**

Event No. 1	Event No.2	Both events at a time
Seed shape	Seed colour	Seed shape and colour
Independent Probability to be:	Independent Probability to be:	Joint probability of being:
Round = ¾ Round = ¾ Wrinkled = ¼ Wrinkled = ¼	yellow = ¼ green = ¼ yellow = ¼ green = ¼	Round yellow = ¾ x ¾ = 9/16 Round green = ¾ x ¼ = 3/16 Wrinkled yellow = ¾ x ¼ = 3/16 Wrinkled green = ¼ x ¼ = 1/16

DOMINANCE RELATIONS

Dominance is a physiological effect of an allele over its partner allele on the same gene locus.

- There are four types of dominance relations among alleles each indicating a different style of their functional effect upon each other.

Feature	Complete Dominance	Incomplete Dominance	Co-dominance	Over Dominance
Alleles in Heterozygote	One allele completely masks effect of other.	Both alleles are expressed partially.	Both alleles are expressed fully.	One allele boosts effect of other allele.
Phenotype of Heterozygote	Resembles with one homozygote	Intermediate between both homozygotes	Distinct from both homozygotes.	Exceeds in quantity from homozygote.
Expression of	Capital letter for	Different	Different	Different

Alleles	dominant and small letter for recessive.	expression e.g. R1 and R2	expression e.g. M and N	expression for dominant and recessive e.g. W+ and w.
Phenotype & genotype Rations	Different	Same	Same	Same
Examples	All seven traits studied by Mendel	Flower colour in 4 O' clock plant	AB and MN blood groups	Eye colour of Drosophila

MULTIPLE ALLELES

- All such altered alternative forms of a gene, whose number is more than two are called multiple alleles.
- Some genes may have as many as 300 alleles.
- Any two of these multiple alleles can be present in the genome of a diploid organism, but a haploid organism or a gamete can have just one of them in its genome.
  Gene mutations may produce many different alleles of a gene

ABO BLOOD GROUP SYSTEM

- ABO blood group is first discovered multiple allelic blood group system in man.
- This blood group system is encoded by a single polymorphic gene I on chromosome 9. It has three multiple alleles I^A, I^B and i.
- Allele I^A specifies production of antigen A, allele I^B specifies production of antigen B but allele I does not specify any antigen.
- Alleles I^A and I^B are codominant for each other while completely dominant over i.

PHENOTYPES & GENOTYPES

PHENOTYPE	GENOTYPE	ANTIGEN	ANTIBODY
A	I^AI^A, I^Ai	A	Anti-B antibody
B	I^BI^B, I^Bi	B	Anti-A antibody
AB	I^AI^B	A & B	No Antibody
O	Ii	No	Anti – A antibody Anti – B antibody

- Positive or negative sign of blood group refers to the presence or absence of another blood group system antigen called Rh factor.
- **Rh blood group system** is defined on the basis of Rh factor present on the surface of RBCs.
- Rh blood group system is encoded by three genes C, D and E which occupy two tightly linked loci.
- Alleles of gene D occupy one locus called locus D, while genes C and E alternatively occupy the other locus. The D locus is of prime importance.
- **Gene D has two alleles, D and d. D is completely dominant over d.**

POLYGENIC INHERITANCE

- Such traits which are encoded by alleles of two or more different gene pairs found at different loci, all influencing the same trait in an additive way are called polygenic traits and their genes are polygenes.
- These are also called as continuously varying traits or quantitative traits.
- Each polygene has a small positive or negative effect on character.

- Polygenes supplement each other and sum of positive or negative effects of all individual polygenes produce quantitative phenotypes of a continuously varying trait.
- These traits produce a smooth bell-shaped curve.
- **Kernel** colour of wheat grain is determined by 3 gene pairs.
- **Human skin** colour is determined by 3-6 gene pairs.
- **Human height and intelligence are polygenic traits.**

EPISTASIS

- When an effect caused by a gene pair at one locus interferes with or hides the effect caused by another gene or gene pair at another locus, such a phenomenon of gene interaction is called epistasis.

PLEIOTROPY

- When a single gene affects two or more traits, the phenomenon is called pleiotropy. Such a gene with multiple phenotypic effect is called pleiotropic. e.g. Genes that affect growth rate in humans also influence both weight and height.

GENE LINKAGE

- Phenomenon of staying together of all the genes of a chromosome is called gene linkage.
- Gene linkage is a physical relationship between genes.
- A chromosome carries its linked genes en block in form of linkage group.
- The number of linkage groups corresponds to the number of homologous pairs of chromosomes.
- **Man has 23 linkage groups.**
- Genes for **colour blindness, haemophilia, gout** etc form one linkage group on human X chromosome.
- Gene for **sickle cell anaemia, leukemia and albinism** etc form linkage group on human chromosome 11.

RECOMBINATION FREQUENCY

It is the proportion of recombinant types between two gene pairs as compared to sum off all combinations.

$$\textbf{Recombination frequency} = \textbf{Recombinant types / Sum off all combinations} \times 100$$

The recombination frequencies between two linked genes can be calculated by backcrossing the heterozygote to a homozygous double recessive.

SEX CHROMOSOMES AND SEX DETERMINATION

- Chromosomes which are different in male and female and have genes for determination of sex are called sex chromosome.
- All chromosomes other than sex chromosomes are called autosomes. Autosomes do not carry any sex determining gene.
- Humans have 46 chromosomes in form of 23 pairs.
- 22 pairs are of autosomes and one pair is of sex chromosomes.
- Autosome pairs are common in both the sexes but 23rd sex chromosome pair is very different in male and female.
- A female has two similar X chromosomes in her 23rd pair but a man has an X chromosome along with a much shorter Y chromosome in his 23rd pair.
- The 23rd pair in man is heteromorphic. She is XX but he is XY.
- **SRY is the male determining gene. It is located at the tip of short arm of Y chromosome.**

It is male sex switches and expressed during 6th week of pregnancy.

PATTERNS OF SEX DETERMINATION

FEATURE	XO-XX	XY-XX	ZZ-ZW
Examples	Grasshopper, Protenor bug	Human, Drosophila	Birds, Butterflies, Moths
Male	XO	XY	ZZ
	Heterogametic	Heterogametic	Homogametic
Female	XX	XX	ZW
	Homogametic	Homogametic	Heterogametic
Sex Determining Gamete	Sperm	Sperm	Egg
Sex Ratio	1:1	1:1	1:1

SEX LINKAGE IN HUMANS

- A trait whose gene is present on X chromosome is called X-linked trait. **X-linked traits** are commonly referred as sex-linked traits.
- X-linked recessive traits are common in male while X-linked dominant traits are common in female.
- X-linked traits follow **zig zag path** while Y-linked traits are transmitted in **straight way.**
- Genes located on Y chromosomes are called Y-linked genes and their traits are called Y-linked traits.
- Such traits whose genes are located on both X & Y chromosomes are called X & Y linked or pseudoautosomal traits such genes are called X-and –Y linked genes.

HAEMOPHILIA

- It is a rare X-linked recessive trait.
- Haemophiliac's blood fails to clot properly after an injury, because it has either reduction or malfunction or complete absence of blood clotting factors.
- It is a serious heredity disease because a haemophiliac may bleed to death even from minor cuts.

TYPES OF HAEMOPHILIA

TYPE	OCCURRENCE	FACTOR	GENETICS
A	80%	VIII	X-linked recessive
B	20%	IX	X-linked recessive
C	Less than 1%	XI	Autosomal recessive

- Haemophilia A and B are non-allelic recessive sex-linked but haemophilia C is an autosomal recessive trait.
- Haemophilia A and B have more chances in male as compared to female while haemophilia C has equal chances in both male and female.
- Haemophilia A zig Zag from maternal grandfather through a carrier daughter to a grandson.
- It never passes direct from father to son.

COLOUR BLINDNESS

- Normal trichromatic colour vision is based on three different kinds of cone cells in the retina, each sensitive to one of the three primary colours, red, green or blue.
- Each type of cone cell has specific light absorbing proteins called opsins.
- The genes for red and green opsins are on X chromosome while the gene for blue opsin is present on autosome 7.

TYPES OF COLOUR BLINDNESS

- Mutations in opsin genes cause three types of colour blindness:

(i) Dichromacy

- A dichromat can perceive two primary colours but is unable to perceive one whose opsins are missing due to mutation.
-

Type	Blindness	Perception
Protanopia	Red blindness	Green, Blue
Deuteranopia	Green blindness	Red, Blue
Tritanopia	Blue blindness	Red, Green

(ii) Protanomalous

- Some people can detect red and green but with altered perception of the relative shades of these colours.
- They have abnormal but still partially functional opsins.
- They are protanomalous and deuteranomalous for red and green weakness respectively.

(iii) Monochromacy

- A monochromat can perceive only one colour. Monochromacy is true colour-blindness.
- **Blue cone monochromacy** is an x-linked recessive trait in which red and green cone cells are absent.
- It is a common heredity disease.
- Like any sex-linked recessive traits, it also zigzags from maternal grandfather through a carrier daughter to a grandson.
- It never passes direct from father to son.
- This type of colour blindness is more common in men than women, because chances for a male to be affected by it are much more than a female.
- **Testicular feminization syndrome is a rare X**-linked recessive trait in which person has X & Y chromosomes yet tfm genes on their X-chromosome develops them physically into female.
- **A sex-limited trait** is limited to only sex due to anatomical differences e.g. beard growth in human male and milk yield in cows.
- **Sex influenced traits** occur in both males and females, but they are more common in one sex e.g. pattern baldness. These are influenced by hormonal differences.

DIABETES MELLITUS

- Two main types of diabetes.
  1) IDDM 2) NIDDM
- ***Diabetes*** is a heterogeneous group of disorders, which are characterized by elevated blood sugar level.
- ***Insulin*** gene is located on short arm of **chromosome 11.**
- About 2%-5% of type II diabetics get the disease early in life, before 25 years of age. It is called maturity onset diabetes of the young (MODY).
- 50% of MODY are caused by mutation in glucokinase 1 gene.

FEATURE	TYPE I	TYPE II
Other name	IDDM	NIDDM
Age of incidence	Juvenile diabetes	Senile diabetes
	Before 40 years	After 40 years

Cause	Decreased insulin production due to autoimmune response	Increased resistance of cells to insulin mainly due to obesity
Percentage	10%	90%
Treatment	Exogenous Insulin	Exercise

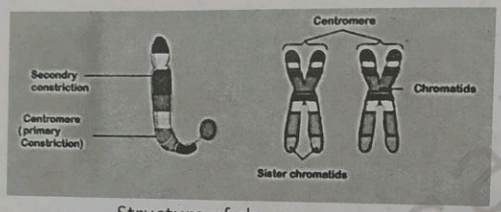
CHROMOSOMES & DNA

COURSE CONTENT

- Chromosome: Nucleosome, DNA, Histone Proteins, Chromatids, Centromere and Telomeres.
- Gene as a Basic Unit of Genetic Information
- DNA Replication: Hypothesis of DNA Replication, Meselson & Stahl's experiment and Replication
- Transcription
- Genetic Code
- Translation

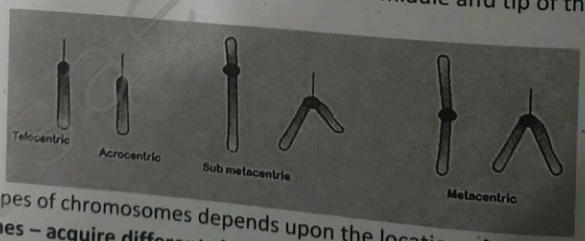
TYPES OF CHROMOSOMES

- Typically, a chromosome is made of chromatids, centromere, (primary constriction), and a secondary constriction.



Structure of chromosome

- Chromosomes may widely differ in appearance. They vary in size, staining properties, the location of centromere, relative length of two arms on either side of centromere, and the position of constricted regions along the arms.
- **The particular array of chromosomes that an individual possesses is called its karyotype.**
- Karyotypes show marked differences among species and sometimes even among individuals of the same species.
- The chromosomes are called telocentric, acrocentric, sub metacentric and metacentric depending upon the location of centromere between the middle and tip of the chromosomes.



Shapes of chromosomes depends upon the location of centromere

- **These chromosomes – acquire different shapes at the time of anaphase during cell division. The usual shapes are I, j and v.**

NUCLEOSOME

- **Every 200 nucleotides, the DNA duplex is coiled around a core of eight histone proteins forming a complex known as a nucleosome.**
- Unlike most proteins, which have an overall negative charge, histones are positively charged due to an abundance of the basic amino acids arginine and lysine.
- They are thus strongly attracted to the negatively charged phosphate groups of the DNA. The histone cores thus act as magnetic forms that promote and guide the coiling of the DNA. Further coiling occurs when the string of nucleosomes wraps up into higher order coils called supercoils.

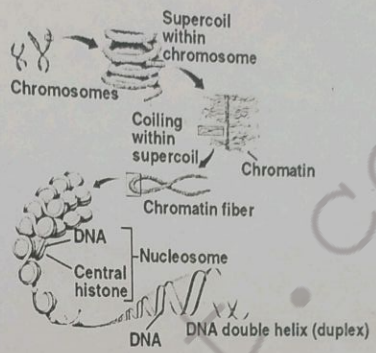


Fig. 20.5 Levels of eukaryotic chromosomal organization

Heterochromatin

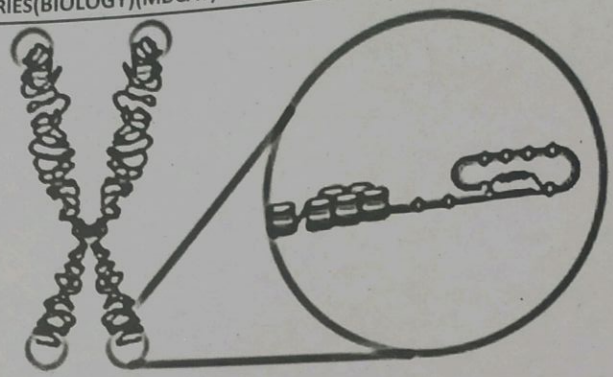
- Highly condensed portions of the chromatin are called heterochromatin. Some of these portions remain permanently condensed, so that their DNA is never expressed.

Euchromatin

- The remainder of the chromosome called euchromatin is condensed only during cell division, When compact packaging facilitates the movement of the chromosomes.
- At all other times, euchromatin is present in an open configuration and its genes can be expressed.
- The way, chromatin is packaged when the cell is not dividing is not well understood beyond the level of nucleosomes and is a topic of intensive research.

TELOMERE

- **A specialized non - transcribed structure that caps each end of chromosome.**
- Telomeres are repetitive nucleotide sequences located at the termini of linear chromosomes of most eukaryotic organisms.
- Most prokaryotes, having circular chromosomes rather than linear, do not have telomeres.
- Telomeres compensate for incomplete semi – conservative DNA replication at chromosomal ends.



Telomere Function

- Telomeres function to protect the ends of chromosomes.
- They prevent one chromosome from binding to another (DNA is sticky).
- They also don't have any genetic information.
- During DNA replication because we lose a bit of DNA with each round of cell division, so the telomeres protect the chromosomes so they are not lost.

DNA REPLICATION

- Semiconservative replication model was presented by Watson & Crick.
- Semi-conservative replication was confirmed by **Meselson and Stahl.**
- In **Semi conservative replication,** the sequence of the original duplex is conserved after one round of replication, the duplex itself is not
- According to **conservative model,** parental double helix would remain intact and generate DNA copies consisting of entirely new molecules
- According to **dispersive model,** parental DNA would become completely dispersed and each strand of all daughter molecules would be a mixture of old and new DNA.

• Model	Primary Structure	Secondary Structure
Conservative Model	Conserved	Conserved
Dispersive Model	Lost	Lost
Semi-conservative Model	Conserved	Lost

MESELSON-STAHL EXPERIMENT

- They grew bacteria in a medium containing heavy isotopes incorporated into the bases of the bacterial DNA

STEP I

Growth of Bacteria in Artificial Medium

- They grew bacteria in a medium containing heavy isotope of nitrogen, N^{15}, which became incorporated into the bases of the bacterial DNA. After several generations, the DNA of these bacteria was denser than that of bacteria grown in a medium containing the lighter isotope of isotope of nitrogen, N^{14}.

- Then they transferred the bacteria from the N^{15} medium to the N^{14} medium and collected the DNA at various intervals.

STEP II

Ultracentrifugation

- They dissolved the DNA in Cesium Chloride and then spun it at a very high speed in an ultracentrifuge. DNA strands of different densities got separated.
- Each DNA floats or sinks in the gradient until it reaches the position where its density exactly matches the density of cesium there.
- Because N^{15} strands are denser than N^{14} strands, they migrate farther down the tubes to a denser region of the cesium chloride gradient.

Observations

- The DNA collected immediately after the transfer was all dense.
- After the bacteria completed their first round of DNA replication in the N^{14} medium, the density of their DNA had decreased to a value intermediate between N^{14} –DNA and N^{15} –DNA.
- After the second round of replication, two density classes of DNA were observed, one intermediate and one equal to that of N^{14} – DNA.
- After the first round of replication, each daughter DNA duplex was a hybrid possessing one of the heavy strand of parent molecule and one light strand.
- When this hybrid duplex replicated, it contributed one heavy strand to form another hybrid duplex and one light strand to form a light duplex.
- This experiment clearly confirms the prediction of Watson - Crick model that DNA replicates in a semi-conservative manner.

THE REPLICATION PROCESS

- The DNA replication begins at one or more sites on the DNA molecule, where there is specific sequence of nucleotides.

Enzymes Involved

Helicase

- It opens the double helix of DNA by breaking hydrogen bonds.

Primase

- Primase constructs an RNA primer, a sequence of about 10 RNA nucleotides complementary to the parent DNA template

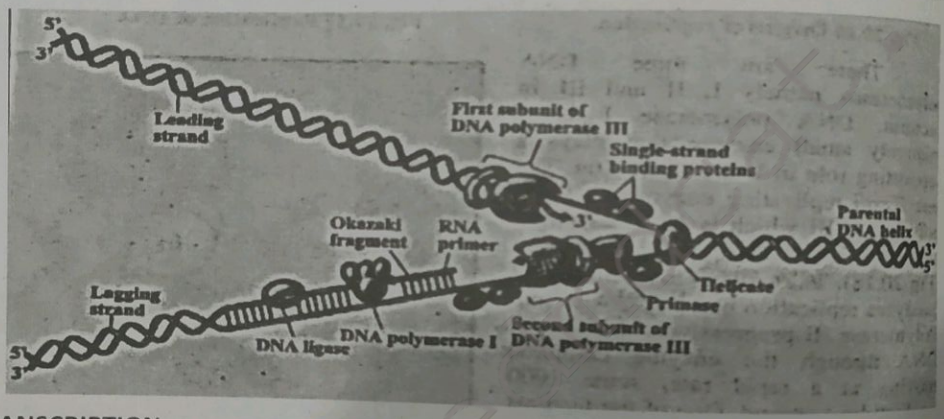
DNA Polymerases

- DNA polymerases catalyze addition of nucleotides to the complementary strand of DNA.
- They are of three types I, II and III in bacteria.
- The true E.coli replicating enzyme is DNA polymerase III which is 10 times larger.
- This enzyme is a dimer and catalyzes replication of one strand.
- **Rate of replication** is 1000 nucleotides / sec.
- It can add nucleotides only to a chain of nucleotides that is already paired with the parent strands.
- DNA polymerase cannot initiate synthesis on its own.
- It can add nucleotides to the 3' end of a DNA strand so replication always proceeds from 5' → 3' direction on a growing DNA strand.
- **DNA Ligase** It connects DNA fragments together.

Following steps are involved during DNA replication:

(i) Helicase opens double helix of DNA.
(ii) Primase adds primer complementary to DNA.
(iii) DNA polymerase III recognizes primer and constructs new strand in 5′ → 3′.
(iv) Leading strand, which elongates towards the replication fork, is built simple by adding nucleotides continuously to its growing 3′ end.

- **Lagging strand,** which elongates away from replication fork, is synthesized discontinuously as a series of short segments that are later connected.
- These segments called **Okazaki fragments** are 100-200 nucleotides long in eukaryotes and 1000-2000 nucleotides long in prokaryotes. Each segment is synthesized in 5′ → 3′, beginning at the replication fork and moving away from it.
- When the polymerase reaches the 5′ end of the lagging strand, **DNA ligase** connects these Okazaki fragments.
- The DNA is further unwound, new RNA primers are constructed and DNA polymerase III then jumps ahead 1000-2000 nucleotides (towards the replication fork) to construct another fragment.

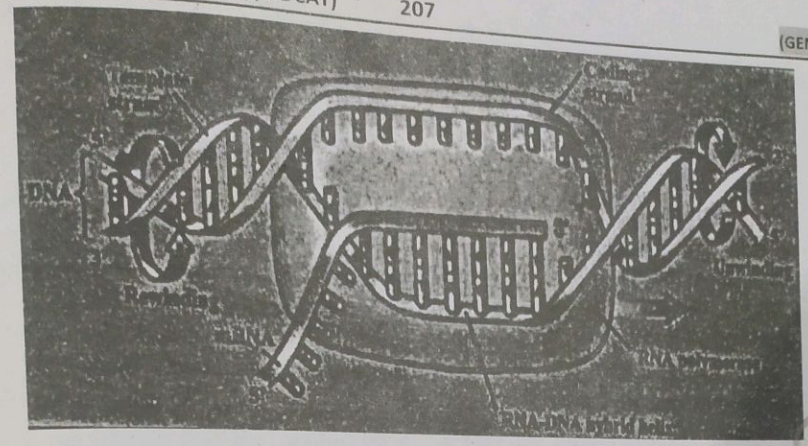


TRANSCRIPTION

- Transcription is the process by which an RNA copy of the DNA sequence encoding the gene is produced with the help of an enzyme, **RNA polymerase.**
- **Only one of the two strands of DNA are transcribed. This strand is called template strand or the antisense strand.**
- **The opposite strand is called coding strand or the sense strand.**

Role of RNA Polymerase

- RNA polymerase enzyme synthesizes RNA 5′ to 3′
- There is only one type of RNA in prokaryotes which is responsible for the synthesis of all three types of RNAs.
- In eukaryotes, **RNA polymerase I** synthesizes **rRNA, RNA polymerase II** mRNA and **RNA polymerase III** synthesizes tRNA.
- Transcription starts from promoter on DNA template strand.
- The binding of RNA polymerase to the promotor is the first step in gene transcription.
- Promotor is located upstream of gene.



- Two binding sites in prokaryotes and eukaryotes are:

PROMOTOR SITE	PROKARYOTE	EUKARYOTE
TTGACA	-35	-75
TATAAT	-10	-25

- One of the subunit of RNA polymerase sigma factor, is responsible for correct initiation of transcription process.
- Once the transcription has started the sigma factor is released and the remaining part of the enzyme (core enzyme) moves on the template strand and completes the transcription of the gene.
- The DNA strands open up at the place where enzyme is attached to the template strand forming transcription bubble.
- The transcription bubble moves down the DNA, leaving the growing strand protruding from the bubble.
- The stop sequences at the end of gene terminate the synthesis of mRNA.
- The simplest stop signal is a series of GC base pairs followed by a series of AT base pairs.
- The RNA formed in this region forms a GC hairpin followed by four or more U ribonucleotides.
- The hairpin causes RNA polymerase to stop synthesis.
- In **bacteria** newly, synthesized mRNA is directly released into the cytoplasm.
- In **eukaryotes,** mRNA has to travel a large distance from inside the nucleus to ribosomes outside in cytoplasm.
- In **eukaryotes** mRNA is protected from action of nucleases and phosphatases by addition of 7-methyl GTP is linked 5′ to 5′ with first nucleotide while poly A tail linked to 3′ end of the RNA.

GENETIC CODE

- Genetic code is a combination of three nucleotides, which specify a particular amino acid so it is a ***triplet code***.

- ***Marshal Nirenberg, Philip Leader and Khorana*** tested all 64 codons by making artificial mRNAs and triplet codons and using them to synthesize protein or amino-acyl tRNA complexes in cell free system.
- Out of 64 codons, 3 codons UAA, UAG and UGA do not code for any amino acid and so known as ***nonsense codon***.
- Every gene starts with initiation codon AUG, which encodes the amino acid methionine. This is called ***start codon***.
- ***Genetic code is not quite universal*** because UGA codon which is normally a stop codon but in mitochondria appears as tryptophan.
- ***AUA*** specifies isoleucine when it is nuclear while it specifies methionine in mitochondria.
- ***AGA & AGG*** specify arginine when it is nuclear while these act as stop codons in mitochondria.

1st base

2nd base	U		C		A		G		3rd base
U	UUU	Phenylalanine	UCU	Serine	UAU	Tyrosine	UGU	Cysteine	U
	UUC	Phenylalanine	UCC	Serine	UAC	Tyrosine	UGC	Cysteine	C
	UUA	Leucine	UCA	Serine	UAA	Stop	UGA	Stop	A
	UUG	Leucine	UCG	Serine	UAG	Stop	UGG	Tryptophan	G
C	CUU	Leucine	CCU	Proline	CAU	Histidine	CGU	Arginine	U
	CUC	Leucine	CCC	Proline	CAC	Histidine	CGC	Arginine	C
	CUA	Leucine	CCA	Proline	CAA	Glutamine	CGA	Arginine	A
	CUG	Leucine	CCG	Proline	CAG	Glutamine	CGG	Arginine	G
A	AUU	Isoleucine	ACU	Threonine	AAU	Asparagine	AGU	Serine	U
	AUC	Isoleucine	ACC	Threonine	AAC	Asparagine	AGC	Serine	C
	AUA	Isoleucine	ACA	Threonine	AAA	Lysine	AGA	Arginine	A
	AUG	Methionine (Start)	ACG	Threonine	AAG	Lysine	AGG	Arginine	G
G	GUU	Valine	GCU	Alanine	GAU	Aspartic Acid	GGU	Glycine	U
	GUC	Valine	GCC	Alanine	GAC	Aspartic Acid	GGC	Glycine	C
	GUA	Valine	GCA	Alanine	GAA	Glutamic Acid	GGA	Glycine	A
	GUG	Valine	GCG	Alanine	GAG	Glutamic Acid	GGG	Glycine	G

TRANSLATION

It is the process by which amino acids are arranged in form of polypeptide chain according to sequence of nucleotides in mRNA.

Particular tRNA molecules become attached to specific amino acids through the action of activating enzymes called aminoacyl tRNA synthetase.

For 20 different amino acids, there are 20 different tRNA and enzymes.

In prokaryotes, polypeptide synthesis begins with the formation of initiation complex.

First a tRNA molecule carrying a chemically modified methionine (called N-formyl methionine) binds to the small ribosomal subunit.

Initiation factor position the tRNA on the ribosomal surface at the P site (peptidyl site) where peptide bond will form. Nearby two other sites will form.

A site (for aminoacyl site) where successive aminoacyl-tRNA will bind.

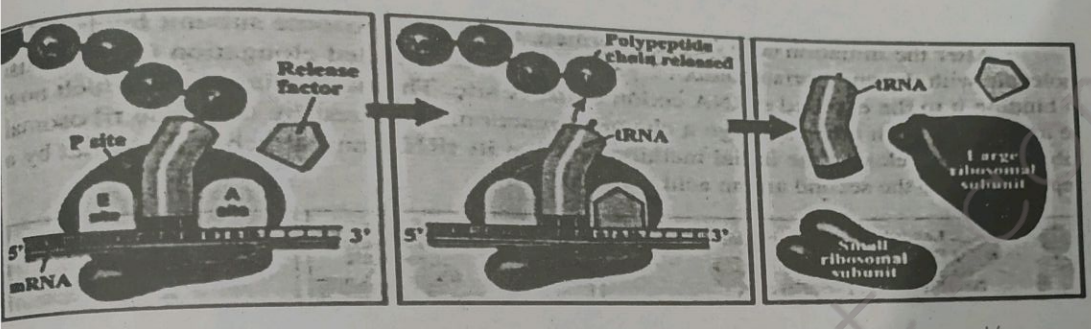
E site (for exit site) where empty tRNA will exit the ribosome.

This initiation complex, guided by another initiation factor, binds to AUG on the mRNA.

Large ribosomal subunit binds with small subunit on mRNA.

An elongation factor binds another aminoacyl-tRNA at A site.

- The two amino acids which now lie adjacent to each other undergo a chemical reaction, catalyzed by the large ribosomal subunit, which releases the initial methionine from its tRNA and attached it by a peptide bond to the second amino acid.
- The ribosome now moves (translocate) three more nucleotides along the mRNA molecule in the **5'→3' direction,** guided by another elongation factor. This movement translocate the initial tRNA to the E site and ejects it from the ribosome and repositions the growing polypeptide.
- Same process is repeated again and again.



- Elongation continues in this fashion until a chain-terminating non-sense codon is exposed (e.g. UAA)
- Nonsense codons do not bind to tRNA they are recognized by release factors, proteins that release the newly made polypeptide from the ribosomes.

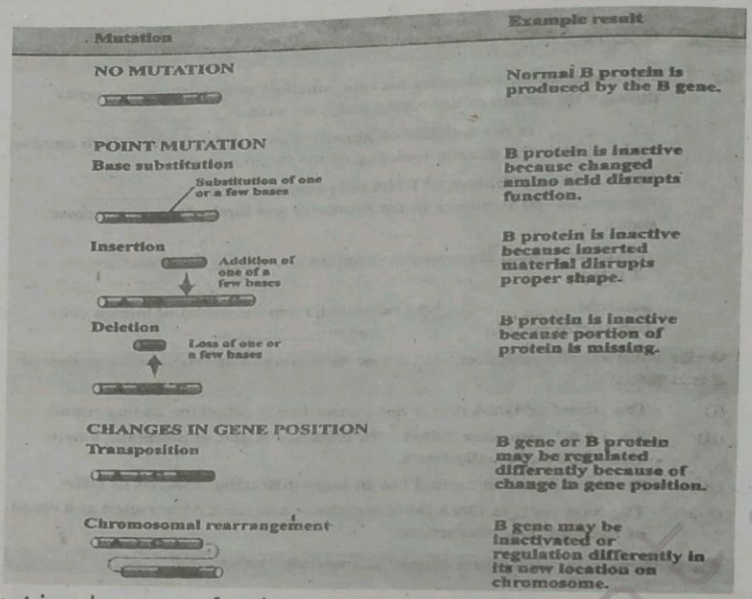
MUTATIONS

- Any change in heredity material/ DNA is called mutation.
- Changes in the DNA occur either due to mistake in replication or damage to the genetic message causing mutations.
- The mutations in somatic cells do not pass on to offspring and so have little evolutionary consequence than germ line changes.
- The mutation in germ line cell is passed to subsequent generations thus providing raw material from which natural selection produces evolutionary change.
- Mutations can broadly be classified as:
  - (i) **Chromosomal Aberration**
  - (ii) **Point Mutation**

(i) Chromosomal Aberration

Chromosomal aberrations are mega-changes which involve:

- Presence of an extra chromosome
- Loss of chromosome
- Deletions, insertions, inversion etc in the parts of chromosome.
- Such chromosomal aberrations lead to syndromes like Down's syndrome, Klinefelter's syndrome etc.



- **Alterations that involve one or few base pairs in the coding sequence are called point mutations.**
- Some point mutations occur due to spontaneous pairing errors that occur during DNA replication.
- Some point mutations result from damage to DNA caused by mutagens, usually radiations or chemicals.
- **In sickle cell anemia,** a point mutation leads to change of amino acid glutamic acid into valine at position 6 from N terminal end in hemoglobin β chain, this consequently alters the tertiary structure of the hemoglobin molecule, reducing its ability to carry oxygen.

In phenylketonuria, phenylalanine is not degraded because of defective enzyme phenylalanine hydroxylase. Phenylalanine consequently accumulates in the cell leading to mental retardation, as brain fails to develop in infancy.

CELL CYCLE

COURSE CONTENT

- Cell Cycle: Interphase (G1, S and G2 phases), Mitotic phase and Cytokinesis
- Mitosis: Process of Mitosis, Significance of Mitosis
- Meiosis: Process of Meiosis and significance of Meiosis

- **The cell undergoes a sequence of changes, which involves period of growth, replication of DNA, followed by cell division. This sequence of changes is called cell cycle.**
- It comprises two phases viz., **interphase** which is the period of non – apparent division and the period of division also known as **mitotic phase.**
- In human cells, average cell cycle is about 24 hours while in yeast is of only 90 minutes.

INTERPHASE

- It is period of non-apparent division.
- It is period between two consecutive divisions.
- It was misleadingly called as resting phase.
- It is period of great biochemical activity.
- **It is further divided into G1-phase, S phase and G2-phase. In humans, mitosis takes 30 minutes, G1 9 hours, S phase 10 hours and G2 4.5 hours.**

G1 Phase

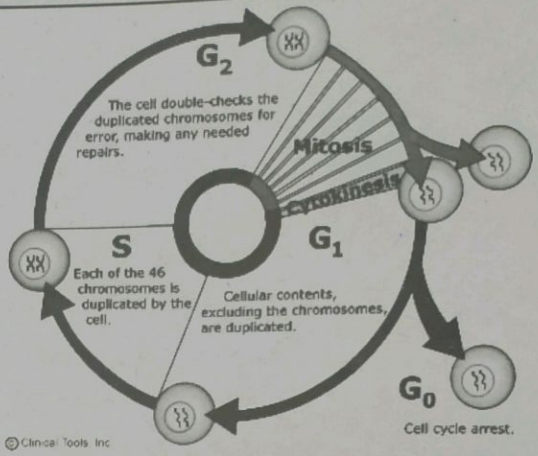
- It is period of extensive metabolic activity.
- In it cell normally grows in size, specific enzymes are synthesized and DNA base units are accumulated for the DNA synthesis.
- Post – mitotic cell can exit the cell cycle during G1 entering a phase called G0 and remain for days, weeks or even some cases throughout life e.g. nerve cells and cells of eye lens.

S Phase

DNA is synthesized and amount of DNA is doubled.

G2 Phase

- It is pre-mitotic phase during which cell is prepared for division.
- Energy storage for chromosome movement, mitosis specific proteins, RNA and microtubule subunits for spindle fibers synthesize.
- Centrioles are duplicated but remain in same centrosome.



MITOSIS:

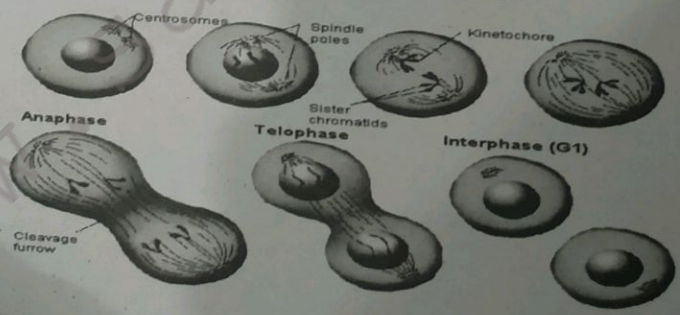
- It is the type of cell division, which ensures the same number of chromosomes in the daughter cells as that in the parent cells.
- It takes place in haploid as well as diploid cells.
- Mitosis is a continuous process but conventionally it can be divided into karyokinesis and cytokinesis.

KARYOKINESIS

- Division of nucleus is called karyokinesis.
- It can further be divided into four phases.

Prophase

- The chromatin material is condensed by folding.
- Chromosomes appear as thin threads (0.25-50 μm in length) at the beginning of prophase.
- Chromosomes become more and more thick ultimately each chromosome is visible having two sister chromatids, attached at centromere.
- Towards the end of prophase, nuclear envelope disappears, nucleoli disappear, and nuclear material is released in the cytoplasm.
- Two pairs of centrioles separate and migrate to opposite sides of the nucleus.
- Mitotic apparatus starts to establish.
- Three sets of microtubules originate from each pair of centrioles.



Metaphase

- The kinetochore fibers of spindle attach to the kinetochore region of chromosome.
- These fibers align chromosomes at the equator forming equatorial plate or metaphase plate.
- Bipolarity is established.
- Each kinetochore gets two fibers, one from each pole.

Anaphase

- It is the most critical phase of mitosis.
- It ensures equal distribution of chromatids in daughter cells.
- The kinetochore fibers contract towards their respective poles, at the same time polar microtubules elongate, exert force and sister chromatids are separated from centromere.
- Half sister chromatids travel towards each pole.

Telophase

- Chromosomes reach at their respective poles.
- The chromosomes decondense due to unfolding, ultimately disappear as chromatin.
- Mitotic apparatus disorganizes.
- Nuclear membrane and nucleoli reappear.
- Two nuclei are formed at two poles of cell.

CYTOKINESIS

- **In Animal Cell**
  Late telophase → Astral microtubules → Activation of actin & myosin → Contractile ring → Cleavage furrow → Two daughter cells
- **In Plant Cell**
  Golgi complex → Vesicles → Phragmoplast → Two daughter cells

IMPORTANCE OF MITOSIS

- Mitosis is important in asexual reproduction, regeneration, healing of wounds, replacement of older cells, development, growth, tissue culture and cloning.
- Hereditary material is equally distributed in the daughter cell. The genetic information remains unchanged generation after generation, thus continuity of similar information is ensured from parent to daughter cell.

MEIOSIS

- In meiosis, chromosome number in daughter cells becomes half as compared to parent cell.
- It takes place in diploid cells only.
- In meiosis only single replication of DNA occurs.
- It has two divisions. First meiotic division is the reduction division. Second meiotic division is mitotic division.

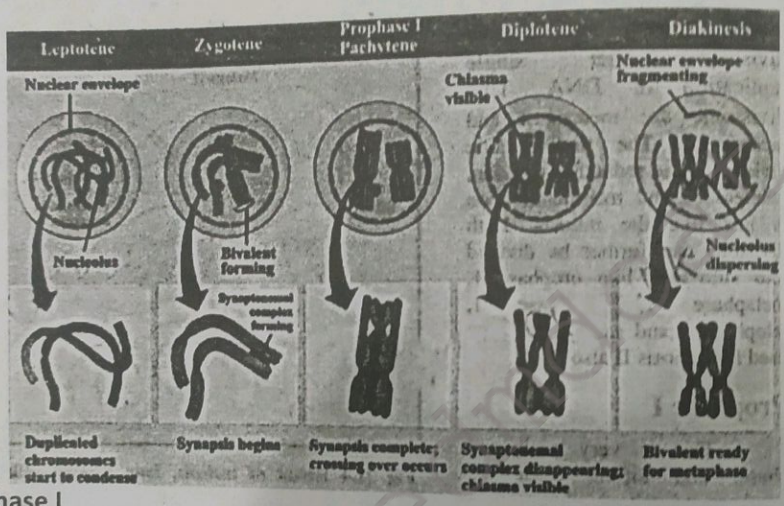
MEIOSIS I

Prophase I

- It is longest phase of meiosis.
- Prophase is further divided into

STAGE	EVENTS
Leptotene	• Condensation of chromosomes occurs. • Size of nucleus increases.

Zygotene	• Synapsis starts i.e. pairing of homologous chromosomes. • Each paired but not fused complex structure is called tetrad or bivalent.
Pachytene	• Pairing is completed • Each bivalent has 4 chromatids, • Non-sister chromatids of homologous chromosomes exchange their segments *due to chiasmata formation,*
Diplotene	• Paired chromosomes repel each other and begin to separate • Homologous chromosomes remain united by chiasmata, • Each bivalent has one such point.
Diakinesis	• Condensation of chromosome completes • Homologous chromosomes united at ends • Nucleoli disappear



Metaphase I

- Eachbivalent i.e. pair of homologous chromosome is arranged on equator of cell.
- Bivalent is still attached at chiasmata.
- Arrangement of bivalent is totally random so it will lead to further genetic variation

Anaphase I

- Spindle fibers contract and pull the bivalent apart
- Chromosomes move towards opposite poles and chromatids are not separated.

Telophase I

- Nuclear membrane is reformed. Cytokinesis occurs.
- Two daughter cells are produced each with haploid (n) chromosome.

MEIOSIS II

Before meiosis II, there is small interphase but there is no DNA replication

Importance of Meiosis

- Meiosis maintains chromosome number constant generation after generation
- **Crossing over and random assortment of chromosomes** are two significant happenings of meiosis

Both these phenomenon cause variations and modifications in the genome which is the **basis for evolution.**

MEIOTIC ERRORS

Non-Disjunction

- Chromosomes fail to segregate during anaphase and telophase and do not finish with equal distribution of chromosome among all the daughter nuclei.
- It results either increase or decrease in the number of chromosome causing serious physical, social and mental disorders.
- It may be in autosome or in sex chromosome.

FEATURE	DOWN'S SYNDROME	KLINEFILTER'S SYNDROME	TURNER'S SYNDROME
Chromosome	21st autosome	Sex chromosome	Sex chromosome
Chromosome No.	Additional 2n+1 47	Additional 2n+1 47	Missing 2n-1 47
Chromosomal Relation	45 autosome + XY	44 autosome+XXY = 47	44 autosome + X
Gamete Involved	Ova (24)	Sperm (24)	Ova (24)
Chances	Teen age mother = 1/1000 40 years = 1/100 45 years = 1/33	1/1500	1/61000
Abortions	1/40	0	1/18
Affected Individuals	• Flat, broad face, • Squint eyes with skin folded in the inner corner, • Protruding tongue, • Mental retardation, • Defective development of CNS	• enlarged breasts • tendency to tallness, • obesity, • Small testies, no sperm at ejaculation, • Under development of secondary sex characters.	• Often do not survive pregnancy, • aborted mostly, if survived have female appearance, • short stature, • Webbed neck, • no ovaries, • complete absences o germ cells.

MCQs Of GENETICS

1. **A woman of blood group "B" whose father was of blood group "O", is married to a man of blood group O, what is the probability of offspring of blood group B:**
   A) 25% B) 50% C) 100% D) 75%
2. **An Rh^- woman is married to an Rh^+ man whose father was also Rh^-. What is the probable risk of erythroblastosis foetalis in their babies:**
   A) 25% B) 50% C) 75% D) 100%
3. **Rh blood group is encoded by ____ genes:**
   A) 2 B) 3 C) 4 D) 1
4. **A man with blood group "A" marries a woman of blood group "B". Both are heterozygous. What are the offsprings having phenotype "O":**
   A) Zero B) 25% C) 50% D) 75%
5. **Feature correct to O-negative blood group:**
   A) A & B antigen present
   B) Anti-A & anti-B antibody present
   C) Rh antigen present
   D) Rh antibody present
6. **Interaction between genes occupying different loci is:**
   A) Dominance B) Epistasis C) Pleiotropy D) Gene linkage
7. **All of the following are continuously varying traits except:**
   A) Kernel colour in wheat
   B) Skin colour in humans
   C) Height in humans
   D) Tongue rolling in humans
8. **Which one is true for crossing over?**
   A) Non-sister chromatids of homologous chromosome, meiosis
   B) Non-sister chromatids of homologous chromosome, mitosis
   C) Sister chromatids of homologous chromosome, meiosis
   D) Sister chromatids of homologous chromosome, mitosis
9. **Skin colour of man is controlled by _____ pairs of chromosome.**
   A) 2-3 B) 8-10 C) 3-6 D) 10-12
10. **Enzyme required for phenylalanine degradation is:**
    A) Phenylalanine oxidase
    B) Phenylalanine dehydrogenase
    C) Phenylalanine hydroxylase
    D) Phenylalanine hydrolase
11. **Example of chromosomal aberration is:**
    A) Sickle cell anemia
    B) Phenylketonuria
    C) Down's syndrome
    D) Alkaptonuria
12. **Colour blindness is more common in men than in women because**
    A) Its allele is situated on 'X' chromosome only
    B) Its allele is recessive
    C) Its allele is recessive and is situated on 'X' Chromosome only
    D) Its allele is dominant and situated on 'X' chromosome only
13. **Monochromatic can**
    A) Perceive one colour
    B) Perceive two colour
    C) Perceive three colour
    D) Perceive no colour
14. **How many allele pair of a Gene controls a trait.**
    A) 1 B) 2 C) 3 D) None
15. **Protanopia is _____blindness**

A) Red B) Blue C) Green D) All of these

16. _____ is stop signal of transcription
A) TUS B) GC hairpin D) Stop codon D) Promoter

17. Genetic codon is _____
A) Universal B) Non universal C) Both D) Found in some organisms

18. Which is not sex chromosomal non-disjunction syndrome
A) Edward B) Metafemale C) Jacobs D) Turners

19. Which is not symptom of Turner 's syndrome
A) Webbed neck B) Without ovaries C) Narrow aorta D) None of these

20. In human cell mitosis takes 30 minutes, G1, 9 hours, the S-phase 10 hours, and G2:
A) 2 hours B) 3 hours C) 4 hours D) 4.5 hours

21. An Rh –ve person must have by birth:
A) Rh antigen C) Rh antibody
B) Rh antisera D) Neither Rh antigen nor Rh antibody

22. Each allele of a gene pair occupies _____ gene locus on_____ chromosome.
A) Same, single C) Different, single
B) Same, homologous D) Same, non-homologous

23. Direction of translation is?
A) $3' \rightarrow 3'$ B) $3' \rightarrow 5'$ C) $5' \rightarrow 5'$ D) $5' \rightarrow 3'$

24. 7 methyl GTP is used as ?
A) cap B) Tail C) Internal D) External

25. In Bacteria "TTGACA" Promoter site is at?
A) – 35 B) – 10 C) – 75 D) – 25

26. The individuals which are universal recipients have:
A) A blood group B) AB blood group C) B blood group D) O blood group

27. All of the following are related with mitosis except:
A) Cloning B) Healing C) Tissue culture D) Conjugation

28. Which of the following depicts the Mendel's dihybrid ratio?
A) 3:1 B) 9:3:3:1 C) 9:7 D) 15:1

29. In dihybrid cross, out of 16 plants obtained, the number of genotypes will be:
A) 4 B) 9 C) 16 D) 12

30. When a true breeding pea plant that has yellow seeds is pollinated by a plant that has green seeds, then all the F1 plants have yellow seeds. This means that the allele for yellow is:
A) Heterozygous B) Recessive C) Dominant D) Lethal

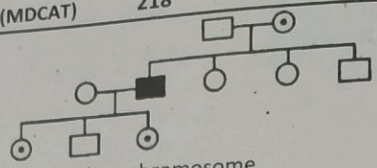
31. Pairing and tetrad formation is characteristics of:
A) Leptotene B) Pachytene C) Zygotene D) Diplotene

32. Blood group B phenotype contains anti-A antibodies in the serum and agglutinate any RBC with antigen:
A) A B) B C) O D) None of these

33. All of the following do not code for any amino acid except:
A) UGA B) UAG C) UAA D) UUG

34. All of the following are considered as physical mutants except:
A) X-rays B) Mustard gas C) UV radiations D) Gamma rays

35. Predict from the following chart:



A) Character is dominant and carried by x chromosome.
B) Character is carried by y chromosome.
C) Character is sex-linked recessive.
D) Character is autosomal recessive.

36. **The process of producing an amino acid polymer (polypeptide) from a RNA template is called**
A) Replication B) Translation C) transcription D) duplication

37. **DNA is replicated:**
A) Conservatively B) Semi-conservatively C) Distributively D) Dispersively

38. **During protein elongation, incoming amino acid would bind to:**
A) P site B) E site C) A site D) Both a & b

39. **A man can suffer from Haemophilia A or B only when he is:**
A) Homozygous dominant C) Hemizygous recessive
B) Homozygous recessive D) Hemizygous dominant

40. **A carrier woman will have a haemophilic son when married to a:**
A) Normal man C) Either normal or hemophiliac man
B) Affected man D) Carrier man

41. **Number of okazaki fragments formed during DNA replication in human cell:**
A) 100 to 200 B) 2000 only C) 1000 to 2000 D) No fixed number

42. **In fungi mitochondria, tryptophan is encoded by:**
A) UGA B) UAG C) UGG D) UAA

43. **In human being normal vision is:**
A) Monochromatic B) Dichromatic C) Trichromatic D) Polychromatic

44. **The gene for blue posing is located on:**
A) X – chromosome B) Autosome 8 C) Autosome 9 D) Autosome 7

45. **What is added to the 3'-end of many eukaryotic mRNAs after transcription?**
A) Introns C) Cap of modified G nucleotide
B) Poly A tail D) Trinucleotide CCA

46. **In protein synthesis termination codons include all except:**
A) UAG B) UGA C) UAA D) UGG

47. **Which of the following gene is Y-linked inheritance?**
A) SRY C) Tfm
B) Hypophosphatemic rickets D) Colour Blindness

48. **Each type of cone cell in retina has specific light absorbing protein called:**
A) Albumin B) Haemolin C) Chlorine D) Opsin

49. **RNA polymerase transcribes a template strand that contains the sequence 5'-GCTACT-3'. The mRNA produced in this transcription will have the sequence:**
A) 5'-GGUACT-3' B) 5'-GGUACU-3' C) 5'-AGUAGC-3' D) 5'-CCUAGA-3'

50. **For 20 different kinds of amino acids there are:**
A) 61 codons B) 64 codons C) 44 codons D) 40 codons

51. **Such traits cannot pass to daughters:**

A) X – linked recessive traits
B) X – linked dominant traits
C) Y – linked traits
D) XX linked traits

52. **Part of gene responsible for formation of RNA is known as:**
A) Promoter region B) Structural region C) Terminator region D) None

53. **Milk yield in dairy cattle and beard growth in human are:**
A) Sex – limited traits
B) Sex – influenced traits
C) Sex – linked traits
D) X – linked traits

54. **The enzyme is a dimer and catalyzes replication of one DNA strand:**
A) DNA Helicase B) DNA polymerase 1 C) DNA polymerase D) DNA polymerase III

55. **AGA specifies arginine in:**
A) Mitochondria B) Bacteria C) Human D) Bacteria and Human

56. **Normal trichromatic colour vision is based on cons of?**
A) Red B) Green C) Blue D) All of these

57. **Red cone monochromacy has_____cons in the retina?**
A) Blue B) Red C) Green D) Both blue and green

58. **In tritanopia?**
A) Green cons are absent and both red and blue are present
B) Red cons are absent and green and blue are present
C) Red and green both are absent and blue is present
D) Red and green both are present and blue is absent

59. **Hypophosphatemic ricket is an x-linked _____ trait:**
A) Dominant B) Both a and b C) Recessive D) None of these

60. **The insulin gene is located on short arm of chromosome?**
A) 9 B) 11 C) 13 D) 15

61. **About _____ % of cases of MODY are caused by mutations in glucokinase gene?**
A) 20 B) 30 C) 40 D) 50

62. **The haemophilia which has abundance of about 20% affects _____ Sex?**
A) Male
B) Female
C) Both male and female equally
D) None

63. **X linked recessive trait is transferred in a manner?**
A) Father to direct son
B) Father to his daughter and then her son
C) Mother to her daughter only
D) None of these

64. **The length of okazaki fragments in eukaryotes is:**
A) 150--250 nucleotides long
B) 200-300 nucleotides
C) 1000-2000 nucleotides
D) 100-200 nucleotides

65. **The abundance of haemophilia which is caused by autosomal gene is?**
A) 80% B) 20% C) 1% D) 90%

66. **DNA contains:**
A) Purines (A and G) pyrimidines (U and (c)
B) Purines (T and (c) pyrimidines (A and G)
C) Purines (A and (c) pyrimidines (U and G)
D) Purines (A and G) pyrimidines (T and (c)

67. **Ascaris incurva male has chromosomes:**
A) 25 Chromosomes
B) 35 Chromosomes
C) 30 Chromosomes
D) 40 Chromosomes

68. **Sex chromosomes XY is present in females of:**
A) Humans B) Drosophila C) Butterflies D) Grass hopper

69. **Nullo gametes are present in:**
A) Humans B) Butterfly C) Grass hopper D) Drosophila

70. **Human shows XX-XY pattern of sex determination which is as same as that of Drosophila. But there are some dissamilarities as XO in Drosophila is?**
A) Male B) Female C) Hermaphrodite D) None

71. **Which 3 codons are nonsense codons?**
A) UAA, UAU, UUA B) UGA, UAG, UAA C) UGG, UGA, UAU D) UGG, UAA, UAG

72. **Examples of chromosomal aberrations are:**
A) Sickle cell anemia B) Phenylketonuria C) Down's syndrome D) Both a and b

73. **Which is incorrect about nucleosome?**
A) 2 turns of DNA coiled round histones C) 200 nucleotides in one nucleosome
B) 8 histones as acidic proteins D) None of these

74. **In mitochondria UGA is/specifies as:**
A) Stop codon B) Tryptophan C) Initiation codon D) Methionine

75. **The main polymerization enzyme in replication process is:**
A) DNA helicase C) DNA polymerase I
B) DNA polymerase III D) DNA ligase

76. **Which one of the following character is a sex limited trait in man?**
A) Beard growth B) Weight C) Height D) Diabetes

77. **In 1925 the genetic basis of ABO system was explained by:**
A) Landsteiner B) Levine C) Bernstein D) Both a and b

78. **He gene for the insertion of sugar onto glycoprotein on the surface of RBC is located on chromosome:**
A) 9 B) 7 C) 19 D) 17

79. **What would be phenotype of a person with genotype I^AI^B, hh, dd?**
A) O -ve B) AB -ve C) AB +ve D) O +ve

80. **Gene linkage is:**
A) Physical relation of genes C) Physiological relation
B) Both of these D) None of these

81. **Which of the following trait is not X linked?**
A) Colour blindness B) Haemophila C) Gout D) Leukemia

82. **Which phenomenon provides the raw material for evolution?**
A) Independent assortment C) Crossing over
B) Gene linkage D) Both a and b

83. **Genotype of a red colored wheat grain will be:**
A) AaBBCC B) AAbbCC C) AABbcc D) AAbbcc

84. **When an individual is having both the alleles of contrasting charters it is said to be**
A) Heterozygous B) Dioeious C) Monoecious D) Hermaphordite

85. **All the genes/ Alleles found in a Breeding population at a given time are collectively called:**
A) Gene pool B) Genotype C) Gene frequency D) Genetic Drift

86. **Crossing over is exchange of chrosomal segments between:**
A) Non sister chromatids of homologous chromosomes
B) Sister chromatids
C) Non sister chromatids of non-homologous chromosomes
D) Any of the above combination

87. **Blood group AB is _____:**
A) Codominant
B) Complete dominant
C) Over dominant
D) a + b

88. **Human skin colour is controlled by:**
A) 2 – 4 gene pairs B) 3 – 5 gene pairs C) 3 – 6 gene pairs D) 2 gene pairs

89. **Bombay phenotype is:**
A) Epistasis
B) Antigen not attached to RBCs
C) Blood is phenotypically O
D) All

90. **The relationship between alleles of the same gene occupying the same locus is:**
A) Co dominance B) Over dominance C) Dominance D) Epistasis

91. **The gene with multiple alleles is called:**
A) Polygenic gene B) Epistatic gene C) Pleiotropic gene D) Polymorphic gene

92. **A gene is said to be_____ when its presence suppresses the effect of a gene at other locus:**
A) Epistasis B) Pleiotropy C) Co dominance D) Bombay phenotype

93. **When a single gene control more than two traits, the phenomenon is:**
A) Epistasis B) Pleiotropy C) Co dominance D) Bombay phenotype

94. **The phenomena of incomplete dominance in 4'O clock plant was discovered by:**
A) Watson B) Bateson C) Darenport D) Carl Correns

95. **When the phenotype of a heterozygote is intermediate between phenotypes of two homozygotes, it is called:**
A) Complete dominance
B) Incomplete dominance
C) Over dominance
D) Co – dominance

96. **Different alleles of a gene that are both expressed in heterozygous condition are called:**
A) Over dominant
B) Incompletely dominant
C) Codominant
D) Completely dominant

97. **A person with genotype "$I^A I^B$, dd & hh" will have a blood group:**
A) AB^{+ve} B) AB^{-ve} C) O^{+ve} D) O^{-ve}

98. **The genetic complement of a trait is called:**
A) Genotype B) Phenotype C) Karyotype D) Genome

99. **An abnormality during meosis during which the chromosomes fail to segregate during anaphase and telophase and equal distribution of chromosome does not take place is:**
A) Disjunction B) Non-disjunction C) Crossing over D) Evolution

100. **The affected individuals in _____ syndrome has one missing X chromosome with only 45 chromosomes (44 autosome + X):**
A) Down's syndrome B) Klinefelter C) Turner's D) Jacobs

Answers:

1.	B	2.	B	3.	B	4.	B	5.	B	6.	B	7.	D	8.	A	9.	C	10.	C
11.	C	12.	C	13.	A	14.	A	15.	A	16.	B	17.	C	18.	A	19.	D	20.	D
21.	D	22.	B	23.	D	24.	A	25.	A	26.	B	27.	D	28.	B	29.	B	30.	C
31	C	32	A	33	D	34	B	35	C	36	B	37	B	38	C	39	C	40	C
41	D	42	A	43	C	44	D	45	B	46	D	47	A	48	D	49	C	50	B
51	C	52	B	53	A	54	D	55	D	56	D	57	B	58	D	59	A	60	B
61	D	62	A	63	B	64	D	65	C	66	D	67	B	68	C	69	C	70	A
71	B	72	D	73	B	74	B	75	B	76	A	77	C	78	C	79	B	80	A
81	D	82	D	83	B	84	A	85	A	86	A	87	D	88	C	89	D	90	C
91	D	92	A	93	B	94	D	95	B	96	C	97	D	98	A	99	B	100	C

ASSESS YOURSELF:

1. **The sex of individuals of next generation always depends on one of the parent, who is:**
   A) Heterogametic B) Homogametic C) Isogametic D) Isomorphic
2. **Which of the following is an example of X-linked recessive trait in humans?**
   A) X^HX^H B) X^HX^h C) X^hY D) X^HY
3. **Which of the following is an example of X-linked recessive trait in humans?**
   A) Hypophosphatemic rickets B) Color blindness C) Baldness D) Beard growth
4. **Which trait in humans is an example of multiple alleles?**
   A) Eye color B) Skin color C) ABO blood group D) Rh- blood group
5. **When a gene pair at one locus interacts with another gene at another locus, the interaction is called:**
   A) Dominance B) Multiple allelism C) Pleiotropy D) Epistasis
6. **When the presence of a gene at one locus suppresses the effect of a gene on another locus, this phenomenon is called:**
   A) Hypostasis B) Pleiotropy C) Epistasis D) Epitropy
7. **The gene for ABO blood group in humans is represented by symbol:**
   A) X B) I C) Y D) O
8. **When a single gene effects two or more traits, the phenomenon is called:**
   A) Epistasis B) Pleiotropy C) Dominance D) Over dominance
9. **In man sex determination depends upon the nature of:**
   A) Heterogametic male C) Heterogametic female
   B) Homogametic female D) Homogametic female
10. **When a gene suppresses the effect of another gene at another locus the phenomenon is termed as??**
    A) Over dominance B) Pleiotropy C) Epistasis D) Co-dominance
11. **Phenylketonuria is an example of?**
    A) Polyploidy B) Transmutation C) Inversion D) Point mutation
12. **A situation in which one gene affects two or more unrelated characters is called??**
    A) Epistasis B) Pleiotropy C) Dominance relation D) Polygenes
13. **The mutation which causes change in the sequence of DNA is called??**
    A) Point mutation C) Deletion
    B) Chromosomal mutation D) Inversion
14. **When a gene suppresses the effect of a gene at another locus, this is called :**
    A) Epistasis C) Complete dominance
    B) Co-dominance D) Mutation
15. **In male the sex determining gene is :**
    A) XY B) SRY C) SXY D) SXX
16. **Monosomy and trisomy can be represented as:**
    A) $2n+1,\ 2n+3$ B) $2n,\ 2n+1$ C) $2n-1,\ 2n-2$ D) $2n-1,\ 2n+1$
17. **Independent assortment of chromosomes took place in:**
    A) Mitosis B) Meiosis I C) Meiosis II D) Interphase

18. **Failure of segregation of chromatids during cell division cycles results in the gain or loss of a chromosome (s) called:**
A) Aneuploidy B) Trisomy C) Polyploidy D) Nullisomy

19. **A continuously varying trait is encoded by alleles of two or more different gene pairs found at different loci, all influencing the same trait in an additive way called:**
A) Polygenic inheritance C) Discontinuous inheritance
B) Monogenic inheritance D) Multifactorial inheritance

20. ***Contraction of spindles occur during:***
A) Prophase B) Metaphase C) Anaphase D) Telophase

21. **The membrane of Golgi vesicle form which of these during cytokinesis of plant cells**
A) Cell plate B) Primary wall C) Cell membrane D) None of these

22. **Age of mother effects which kind of syndrome:**
A) Down B) Turner C) Klinefelter D) None of these

23. **Most crucial phase of mitosis**
A) Prophase B) Metaphase C) Anaphase D) Telophase

24. **If the opposite alleles come together, one of these expresses itself, masking the other. This fact is described as law of:**
A) Dominance B) Limiting factors C) Inheritance D) Segregation

25. **A phase between two cell divisions is called:**
A) Prophase B) Interphase C) Resting phase D) G_0 phase

26. **Human skin color is a good example of:**
A) Sex linked inheritance C) X – linked inheritance
B) Polygenic inheritance D) Y – linked inheritance

27. **How many genotypes are formed in Mendelian dihybrid cross?**
A) 4 B) 9 C) 6 D) 8

28. **What type of gametes will be formed by genotype RrYy?**
A) RY, Ry, rY, ry B) Ry, Ry, Yy, ry C) RY, Ry, ry, ry D) Rr, RR, Yy, YY

29. **The individuals having additional sex chromosomes (44 autosome + XXY) are referred to as:**
A) Down's syndrome B) Klinefelter C) Jacob's D) Patau

30. **The individuals with _____ often do not survive pregnancy and are aborted:**
A) XO B) XX C) XY D) XYY

31. **A person with Bombay phenotype lacks:**
A) Antigen A B) Antigen B C) Antigen A and B D) H substance

32. **The affected individuals have flat, broad face, squint eye, protruding tongue and mental retardation have:**
A) Down's syndrome C) Klinefelter syndrome
B) Turner's syndrome D) Jacob's syndrome

33. **Which of the following genotypes causes Klinefelter syndrome?**
A) XO B) XXY C) XX D) XYY

34. **The term that refers to division of the cytoplasm is:**
A) Cytokinesis B) Apoptosis C) Anaphase D) Karyokinesis

35. **Down's syndrome is a result of Non-disjunction of _____ chromosome**
A) 22nd B) 14th C) 18th D) 21st

36. **Antiserum contains?**
A) Clotting proteins B) Blood corpuscles C) Immunoglobulins D) All are present

37. **How many genes control Rh blood group system?**
A) One B) Three C) Two D) Four

38. **Apoptosis:**
A) Cell death due to tissue damage
B) Causes inflammation
C) Internal programme of events by which cell commits suicide
D) Damages neighboring cells

39. **From each pair of centrioles _____ sets of microtubules originate:**
A) 2 B) 3 C) 4 D) 5

40. **Which statement is incorrect?**
A) In human, cell cycle is about 24 hrs
B) Mitosis takes 30 min
C) G_2 5.5 hrs
D) Yeast cell only 90 min

41. **Mitosis occurs in:**
A) Diploid cells only
B) Haploid cells only
C) Both diploid and haploid cells
D) Monoploid cells

42. **Which of these phases could be called reduction phase**
A) Anaphase I B) Anaphase II C) Anaphase D) None of these

43. **In Mendelian dihybrid cross, how many of progeny in F_2 generation possess genotype rryy?**
A) $\frac{1}{16}$ B) $\frac{2}{16}$ C) $\frac{3}{16}$ D) $\frac{4}{16}$

44. **In case of neurons, post mitotic cell escapes cell cycle and remain in _____ phase without proliferating further:**
A) Go phase B) G1 phase C) G2 phase D) S phase

45. **Mitotic apparatus in animals is formed by:**
A) Aster and spindle
B) Polar and kinetochore microtubules
C) Spindle and RNA
D) Spindle only

46. **A special area of centromere with specific base arrangement and specific proteins where spindle fibers are attached is called:**
A) Chromatin B) Aster C) Kinetochore D) Primary constriction

47. **Which statement is not true about Phragmoplasts?**
A) Formed from vesicle originating from Golgi apparatus
B) Present in plants only
C) Formed at the end of anaphase
D) Centre of dividing cell

48. **Spread of tumor cells and establishment of secondary areas of growth is:**
A) Benign tumors B) Cancer C) Metastasis D) Epistasis

49. **Interphase of meiosis lacks:**
A) G0 phase B) G1 phase C) G2 phase D) S phase

50. **Tetrad or bivalent is:**
A) Paired homologous chromosome but not fused complex structure
B) 2 unpaired homologous chromosome
C) Paired and fused complex structure
D) None of these

51. **A cell of human being has 46 chromosomes; it divides to form some daughter cells, each having 23 pairs of chromosomes. The division would be:**

A) Mitosis B) Meiosis C) Amitosis D) Budding

52. **Microtubules are composed of:**
A) Myoglobin protein
B) Actin and myosin proteins
C) Sphingomyelin and tubulin
D) Tubulin protein and traces of RNA

53. **Mitosis takes place during:**
A) Healing of wound
B) Development and growth
C) Vegetative propagation
D) All of these

54. **Which fibers interdigitate with each other?**
A) Astral fibers B) Kinetochore fibers C) Polar fibers D) All of these

55. **In which of the following cases, genotypic and phenotypic ratio will remain same in F2 generation:**
A) Law of independent assortment
B) Law of Segregation
C) Test cross
D) Incomplete dominance

56. **A pea plant with yellow seed was crossed to a plant having green seeds. What will happen in F1; if plants are true breeding?**
A) All seeds will be yellow
B) All the seeds will be green
C) Half of seeds will be yellow
D) Both will be present in ratio of 1:2:1

57. **A man with blood group "A" marries a woman of blood group "B". Both are heterozygous. What is the off-springs having phenotype "O":**
A) Zero B) 25% C) 50% D) 75%

58. **In Mendelian dihybrid cross, how many individuals are heterozygous of both the character in F_2-generation?**
A) $\frac{1}{16}$ B) $\frac{2}{16}$ C) $\frac{3}{16}$ D) $\frac{4}{16}$

59. **"Gametes are never hybrid". This is a statement of:**
A) Law of dominance
B) Law of independent assortment
C) Law of segregation
D) Law of random fertilization

60. **Which of the following most appropriately describes haemophilia?**
A) Recessive gene disorder
B) Chromosomal disorder
C) X-linked recessive gene disorder
D) Dominant gene disorder

61. **Queen Victoria was a carrier of which disease?**
A) Myotonic dystrophy
B) Haemophilia
C) Sickle-cell anaemia
D) Phenylketonuria

62. **A protein of chromatin with an open configuration is called:**
A) Heterochromatin B) Nucleosome C) Euchromatin D) Centrosome

63. **Okazaki fragments are formed with the strand of DNA called:**
A) Leading strand B) Bothe of these C) Lagging strand D) None of these

64. **Blue opsin is absent in:**
A) Deuteranopia B) Protanopia C) Tritanopia D) Hypotanopia

65. **Sickle cell anemia occurs due to the replacement of _____ by _____ in genetic material:**
A) Valine, Glutamic acid
B) Glutamic acid, Valine
C) Thymine by adenine
D) Adenine by thymine

66. **DNA polymerase cannot _____ on its own:**
A) Carry out replication
B) Initiate replication
C) Add nucleotides to 3^{-} end
D) Recognize primer

67. **Baldness in human is _____ trait:**
A) Sex limited
B) Sex influenced
C) Pseudo autosomal trait
D) Polygenic

68. **The mutation which causes change in sequence of DNA is called:**
A) Point mutation
B) Excision error
C) Chromosomal mutation
D) Chromosomal aberration

69. **Name the site of attachment of Amino-acid on tRNA molecule:**
A) Anticodon
B) 5' end
C) 3' end
D) All of these

70. **Haemophilia A is:**
A) X link
B) Factor VIII
C) Factor IX
D) Both a & b

71. **Protanopia is _____ blindness:**
A) Red
B) Blue
C) Green
D) All of these

72. **With XY chromosome the tfm gene on X chromosome develops physically into:**
A) Female
B) Male
C) Both
D) None

73. **A woman is heterozygous for a recessive X-linked allele that causes haemophilia. Which statement is correct?**
A) All of the gametes she produces will have the allele which causes Haemophilia
B) She is a carrier of Haemophilia
C) None of the gametes she produces will have the allele that causes Haemophilia
D) She is so dominant for Haemophilia genes

74. **During translation it provides the site where polypeptides are assembled:**
A) Transfer RNA
B) Messenger RNA
C) Gene
D) Ribosomal RNA

75. **Pick up the binding sites in promoter of eukaryotes:**
A) – 35 and – 75
B) – 35 and – 10
C) – 35 and – 25
D) – 75 and – 25

76. **Haemophilia C is a mild form of haemophilia affecting:**
A) Male only
B) Female only
C) Both sexes equally
D) None of sexes

77. **It is responsible for correct initiation of transcription:**
A) Initiation factor
B) Elongation factor
C) Sigma factor
D) Transcription factor

78. **Heamophila disease in an example of:**
A) Dominance
B) Complete dominance
C) Incomplete dominance
D) None

79. **Colour blindness is more common in men than in women because:**
A) Its allele is situated on 'X' chromosome only
B) Its allele is recessive
C) Its allele is recessive and is situated on 'X' Chromosome only
D) Its allele is dominant and situated on 'X' chromosome only

80. **_____ is x-linked dominant phenotype:**
A) Hemophilia
B) Colour blindness
C) Anemia
D) Hypophosphatemic

81. **If a couple has three daughters, what are the chances that the fourth child will be a son?**
A) 100%
B) 75%
C) 50%
D) 0%

82. **Monochromatic perceive only colour / colours:**
A) One
B) Two
C) Three
D) No

83. **RNA polymerase consists of:**
A) Sigma factor
B) Core enzyme
C) Sigma factor and Core enzyme
D) Sigma factor and full enzyme

84. **SRY is located on the:**
A) Tip of long arm of Y chromosome
B) Tip of short arm of X chromosome
C) Tip of short arm of Y chromosome
D) Tip of long arm of X chromosome

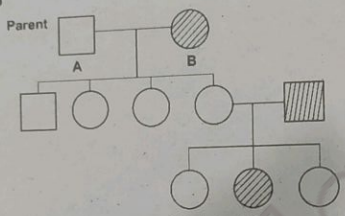
85. **AGA specifies _____ in bacteria, in humans and all other organisms whose genetic code has been studied:**
A) Methionine B) Leucine C) Alanine D) Arginine

86. **The enzymatic synthesis of RNA molecules complementary to a strand of DNA:**
A) Transcription B) Transcription factor C) Transduction D) Transfection

87. **The process in which proteins are synthesized based on information transcribed from DNA:**
A) Revers transcription
B) Translation
C) Protein
D) Palindromic sequence

88. **Human shows XX-XY pattern of sex determination which is as same as that of Drosophila. But there are some dissimilarities as XO in Drosophila is?**
A) Male B) Female C) Hermaphrodite D) None

89. **Which of the given pedigree shows inheritance of autosomal recessive gene. What is the genotype of given parents?**



A) AA, aa B) aa, aa C) Aa, AA D) Aa, Aa

90. **Nucleotide sequence has binding affinity for RNA polymerase in prokaryotes:**
A) – 75 TATAAT B) – 35 TATAAT C) – 33 TATAAT D) – 10 TATAAT

91. **Which type of sex-determination is found in grasshopper?**
A) XO type B) XY type C) ZW type D) Any of these

92. **Haemophilia is related to:**
A) Albinism B) Sickle-cell anaemia C) Colour blindness D) Thalassemia

93. **In Meselson – Stahl experiment after its round of DNA replication, each daughter DNA _____:**
A) Two light strands having N^{14}
B) Two heavy strand having N^{15}
C) Light and Heavy hybrid strand
D) New strands of N^{16}

94. **How many chromosomes are present in human male?**
A) 22 pairs + XX B) 22 pairs + XY C) 22 pairs + YY D) 21 pairs + XY

95. **In the number of insects and mammals the type of sex determination is:**
A) XO type B) XY type C) ZW type D) Any of these

96. **The first step of central dogma is the:**
A) Translation B) Duplication C) Transcription D) Replication

97. **Particular tRNA molecule become attached to specific amino acid through the action of activating enzyme called:**
A) Ligase
B) Aminoacyl tRNA synthetase
C) Polymerase
D) Helicase

98. **Translocation of ribosome on mRNA occurs because of:**
A) Aminoacyl tRNA synthetase
B) Elongation factor
C) Initiation factor
D) Releasing factor

99. **Semi conservative replication was confirmed by:**
A) Meselson and Stahl
B) Franklin and Wilkin
C) Watson and Crick
D) Avery and Macleod

100. **Birds show:**
A) XX- XY
B) ZZ-ZO
C) ZZ-ZW
D) XX-X

CHAPTER 14

BIOTECHNOLOGY

COURSE CONTENT

- Recombinant DNA Technology / Genetic Engineering: Principles of Recombinant DNA Technology and its Application, PCR Gel Electrophoresis and DNA Analysis / Finger Printing
- Gene Therapy
- Transgenic Organisms (Bacteria, Plants and Animals)

RECOMBINANT DNA TECHNOLOGY

- Recombinant DNA contains DNA from two different sources.
- ***Four requirements*** of recombinant DNA technology are:
  - i) Gene of interest which is to be cloned.
  - ii) Molecular scissors to cut out gene of interest.
  - iii) Molecular carrier or vector
  - iv) Expression system
- Gene can be synthesized in the lab from mRNA using ***reverse transcriptase.*** Such DNA molecule produced from mRNA is called ***complementary DNA (cDNA).***

MOLECULAR SCISSORS: RESTRICTION ENDONUCLEASES

- First ***restriction enzyme*** was isolated by Hamilton O. Smith in 1870.
- They are called so because they restrict the growth of viruses.
- **400** restriction enzymes are discovered, **20** commonly used.
- **Palindromic sequences** are sequences of four or six nucleotides arranged symmetrically in the reverse order produced by restriction enzyme.
- ***EcoR1*** is a commonly used restriction enzyme.
- The single standard but complementary ends of the two DNA molecules are called ***sticky ends.***

Molecular Carrier: Vector

- ***Plasmids*** are natural extra chromosomal circular DNA molecules which carry genes for antibiotic resistance and fertility.
- ***pSC 101*** has antibiotic resistance gene for tetracycline.
- ***pBR 322*** has antibiotic resistance gene for tetracycline as well as ampicillin.

Recombinant DNA

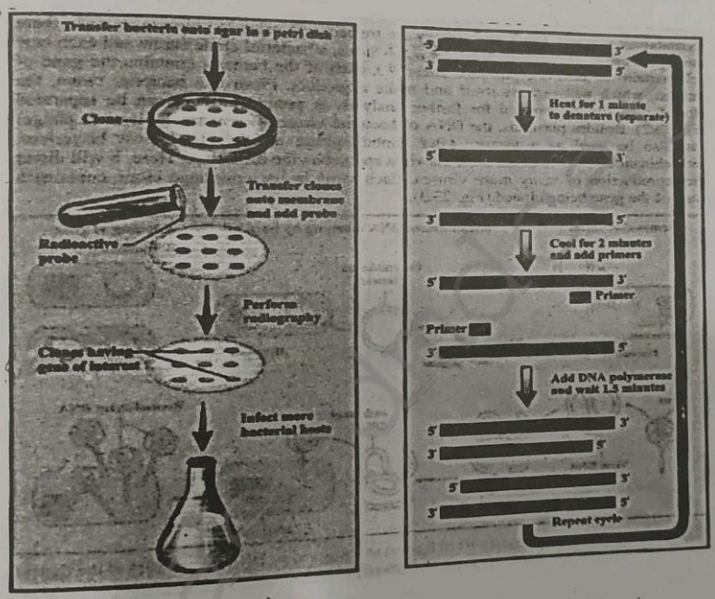
- ***DNA ligase*** is the enzyme which seals the foreign piece of DNA into the vector
- This new DNA is known as ***recombinant DNA or chimaeric DNA***

Expression of the Recombinant DNA

- Bacterial cells take up recombinant plasmid if they are treated with ***calcium chloride*** to make them more permeable.
- ***Lambda phage*** (DNA of bacterial viruses) can also be used as a vector.

POLYMERASE CHAIN REACTION

- ***Polymerase chain reaction*** (PCR) was developed by **Kary B. Mullis in 1983.**
- ***PCR*** takes its name from DNA polymerase, the enzyme that carries out DNA replication process in cell.
- ***Primers*** are the sequences of about 20 bases that are complementary to the bases on either side of the target DNA.
- DNA polymerase used to ***temperature-insensitive*** (thermostable) enzyme extracted from the bacterium
- ***Thermus aquaticus*** , this enzyme is also known as ***Taq polymerase***.

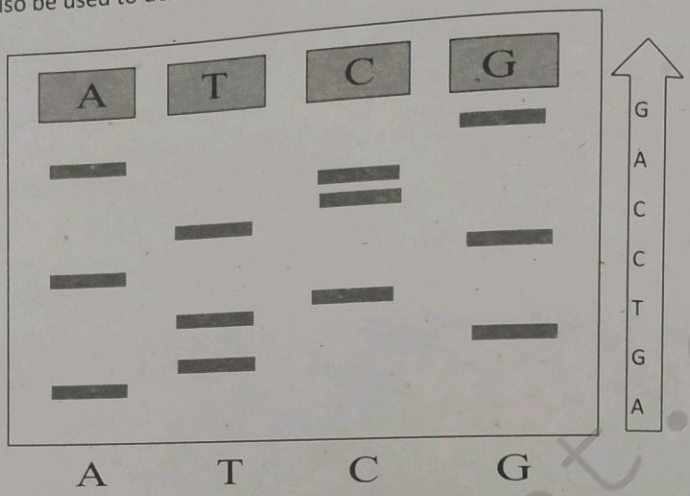


DNA ANALYSIS (DNA FINGERPRINTING)

- It is a process by which entire genome of an individual can be analyzed.
- The genome is treated with restriction enzymes, which results in a unique collection of different sized fragments. These fragments vary in length and restriction enzyme separates according to this length, which is different in different individuals. This process of existing in different lengths is called restriction fragment length polymorphism (RFLPs).
- Fragments of genome can be separated according to their lengths through a process called gel electrophoresis.
- It results in formation of a number of bands that are so close together that they appear as a smear.
- Use of probes for genetic markers produces a distinctive pattern can be recorded on X-ray film.

IMPORTANCE OF DNA ANALYSIS

- It can be used to solve disputes of paternity.
- It is important in forensic laboratories as evidence to solve crimes.
- PCR amplification and DNA analysis can be used to diagnose viral infections, genetic disorders and cancer.
- These can also be used to determine evolutionary history.



GENE SEQUENCING

It is a technique to find sequence of nucleotides in a gene.

- Generation of different sized DNA fragments of all starting from the same point and ending at different points.
- Separation of these different pieces of DNA on agarose gel.
- Reading of sequence from the gel.

METHODS TO GENERATE PIECES OF DNA

For generation of different sized DNA fragment, two methods are generally used.

1) **Sanger's method** in which dideoxyribonucleoside triphosphates are used to terminate DNA synthesis at different sites.
2) **Maxam-Gilbert method** in which DNA threads are chemically cut into pieces of different sizes.

- DNA sequence is now completely automated, robotic devices mix the reagents and then load, run and read the order of nucleotide bases from the gel.
- It is also called as enzymatic or dideoxy method.
- Chain terminating nucleotides labelled with different coloured fluorescent dyes are used.

GENE THERAPY

- ***Gene therapy*** is the insertion of genetic material into human cells for the treatment of a disorder.
- There are two main methods for gene therapy i.e. ***Ex-vivo & In-vivo.***
- Various diseases treated with gene therapy are SCID, familial hypercholesterolemia, cystic fibrosis, cancer, coronary artery blockage, AIDS, hemophilia and diabetes.

DISEASE	CAUSE	DEFECT	METHOD	VECTORS	TARGET CELLS
SCID	ADA Deficiency	Immune deficiency, Life threatening infections	Ex-vivo	Modified retrovirus	Bone marrow stem cells
Familial Hypercholesterolemia	Lack of receptor on liver cells for cholesterol	Fatal heart attacks	Ex-vivo	Modified retrovirus	Liver cells
Cystic Fibrosis	Trans-membrane carrier of Cl^-	Numerous infections of respiratory tract, Thick mucus plug	In-vivo	Liposome-microscopic vesicles (Lipoproteins coated with gene)	Epithelial cell/ Mucous cells/ Goblet cells
Heart Attack	Blockage of coronary artery	Necrosis of myocardium	In-vivo	Plasmid containing gene for vascular endothelial growth factor	Endothelial cells

TRANSGENIC ORGANISMS

Organisms having foreign DNA are called transgenic organisms.

TRANSGENIC BACTERIA:

- Recombinant DNA technology used to produce Bacteria in large vats called bioreactors.
- Biotechnology Products Produced by bacteria
  - i) **Insulin**
  - ii) **Human Growth Hormone**
  - iii) **Tissue plasminogen activator**
  - iv) **Hemophilia factor VIII**
  - v) **Hepatitis B Vaccine**
- Bacteria have been changed from frost – plus to frost – negative to avoid ice crystals.
- Bacteria used against toxic agent.
- Used to cleaning up beaches after oil spills.
- Used as Bio – filters.
- Bacteria also given with "suicide gene" that caused them to self destruct when job is done.
- Strain of bacteria producing phenylalanine an organic chemical to make aspartame.
- Bacteria are used to extract copper, uranium and gold.

TRANSGENIC PLANTS

- Foreign genes are entered into immature plant embryos on in protoplasts.
- Electric current used to make tiny holes so that foreign gene enter easily.
- Foreign genes transferred to cotton, corn and potato strains have made these plants resistant to pests.

- Some corn and cotton plants are both pest and herbicide resistant.
- In 1999 transgenic crops were planted over more than for million acres.
- Also used to enhance the efficiency of rubisco enzyme.
- C_4 cycle is also introduced in plants.
- Plants that use C_4 cycle avoid the inefficiency of carboxylase.
- Plants are also used to produce
- Human Hormones
- Clotting factors
- Antibodies.
- Antibodies are also used as treatment for genital herpes.

TRANSGENIC ANIMALS

- Transgenic animals have been developed by inserting genes into the eggs of animals.
- In order to get transgenic animals, ***two methods*** are used i.e. ***microinjection*** (by hand) and ***vortex mixing method*** by inerting gene into egg. In Vortex method the eggs are placed in an agitator with DNA and silicon-carbide needles. The needles make tiny holes through which the DNA can enter.
- ***Gene pharming*** is the use of transgenic farm animals to procedure pharmaceuticals.
- ***Urine*** is a ***preferable vehicle*** for a biotechnology product than milk because;

1. All animals in herd urinate while only females procedure milk.
2. Animals start to urinate at birth while female do not procedure milk until maturity.
3. It is easier to extract proteins from urine than from milk.

TISSUE CULTURE

- Tissue culture is the growth of a tissue in an artificial liquid culture medium, also called micropropagation.
- German botanist **Gottlieb Haberlandt** in 1902 said that, plant cells are totipotent.
- Cornell botanist F. C. Steward in 1958 first time grew a complete carrot plant from a tiny piece of phloem.
- Tissue culture techniques are used to produce millions of identical seedlings in a limited amount of space. Common methods used in this are following.

MERISTEM CULTURE

- In this method, meristematic cells are used.
- Meristem is virus free portion of plant.
- Different steps involved are:

(i) A small piece of tissue, usually mesophyll tissue from a leaf, is taken and enzymes are added to digest cell wall and convert it into protoplast.

(ii) Protoplasts regenerate a new cell wall and begin to divide due to presence of auxins and cytokinins in liquid medium.

(iii) Clumps of cells are manipulated to produce somatic embryos. These somatic embryos (sometimes called artificial seeds) are encapsulated in a protective hydrated gel. Somatic embryos of tomato, celery, asparagus, lilies, begonias and African violets can be produced in millions in large tanks called bioreactors.

ANTHER CULTURE

- It is a technique in which mature anthers are cultured in a medium containing vitamins and growth regulators.
- It is useful in plants that express recessive alleles.
- Different steps involved are
  - (i) Haploid tube cells within pollen grain divide, producing pro-embryos consisting of as many as 20-40 cells.
  - (ii) Pollen grains rupture releasing haploid embryos.
  - (iii) Haploid plant can be generated or chemical agents are added that encourage chromosomal doubling
  - (iv) After chromosomal doubling, resulting plants are diploid but homozygous for all their alleles.

CELL SUSPENSION CULTURE

- This technique is used to get biotechnology products within culture medium.
- It will no longer be necessary to farm plants for the purpose of acquiring the chemicals they produce.
- Cell suspension cultures of Cinchona ledgeriana produce quinine and Digitalis lanata produce digitoxin.
- Different steps involved are:
- Rapidly growing cultures are cut into small pieces and shaken in a liquid nutrient medium so that single cell or small clumps of cells break off and form a suspension.
- These cells produce the same chemicals as the entire plant.

MCQs of BIOTECHNOLOGY

1. **Molecule that serves to carry the source DNA into new host is:**
   A) Vector B) Host DNA C) Source DNA D) Recombinant DNA
2. **Molecular scissors are also called:**
   A) Palindromes C) Polymerases
   B) Restriction enzymes D) None
3. **Restriction enzymes were isolated by:**
   A) Beadle B) T.H. Morgan C) G. Haberlandt D) Hamilton O. Smith
4. **Chimeric DNA is:**
   A) Mutated DNA B) Recombinant DNA C) Plasmid DNA D) DNA
5. **Full set of genes of an individual is called:**
   A) Genetics B) Genome C) Genomic library D) All of these
6. **How many base pairs are present in human genome:**
   A) 6 billions B) 2 billions C) 3 billions D) 5 billions
7. **The organisms having foreign genes inserted into the genome are called:**
   A) Mutated organisms C) Transgenic organisms
   B) Both a and b D) None
8. **The cells most likely to be used for cloning of transgenic animals:**
   A) Sperm cells B) Somatic cells C) Cumulus cells D) Egg cells
9. **Which one is artificial organ used:**
   A) Organoid B) Organ C) Both a & b D) Synthetic
10. **The machine that is made for achieving the bio-product:**
    A) Bio filter B) Analyzer C) Bioreactor D) All of them
11. **Cloning of a gene can be done by:**
    A) Recombinant DNA technology C) Both
    B) PCR D) Gene therapy
12. **pBR-322 has antibiotic resistant gene for:**
    A) Tetracycline B) Ampicillin C) Both of them D) Streptomycin
13. **A genomic library can be searched by:**
    A) Probe C) Promoter
    B) Primer D) Reverse transcriptase
14. **Which would you not expect to be a biotechnology product:**
    A) Vaccine B) Glycogen C) Protein hormone D) Enzyme
15. **Which is incorrectly matched:**
    A) pBR – Ampicillin restistant C) DNA polymerase – PCR
    B) RFLPs – DNA analysis D) DNA ligase – mapping human chromosome
16. **Cystic fibrosis patients lack a gene that codes for tans-membrane carrier of the:**
    A) Calcium ion B) Chloride ion C) Iron ion D) Sodium ion
17. **Which of followings can be used as a vector:**
    A) Plasmid B) Virus C) Both D) None
18. **The gene of interest can be got by:**
    A) Isolating it from the chromosome C) Making it from mRNA
    B) Chemically synthesizing it D) All of these
19. **Since _____ biotechnology has produced drugs and vaccines:**

A) 1980s B) 1970s C) 1960s D) 1950s

20. **Reverse transcriptase is obtained from:**
A) Bacteria B) Cells C) DNA viruses D) Retroviruses

21. **Enzyme used in PCR is:**
A) Ligase B) *Taq* polymerase C) DNA polymerase D) Both b & c

22. ***Thermus aquaticus* is important in relation to:**
A) *Taq* polymerase B) Ligase C) Helicase D) Primase

23. **Thermocycler is:**
A) PCR process B) PCR machine C) Primers D) Both b and c

24. **The process that separates the DNA fragments according to their lengths is:**
A) DNA samples B) DNA finger printing C) Gel electrophoresis D) All of these

25. **The important application of DNA finger printing is in:**
A) Cytology B) Forensic science C) Genetic engineering D) None

26. **The diagnosis of viral infections, genetic disorders and cancer is done by:**
A) Laboratory test B) Eliza test C) PCR amplification D) All of these

27. **During DNA sequencing, separation of different pieces of DNA is made on:**
A) Agarose gel B) Agar C) Dextrin D) Carrageenan

28. **Which will survive in medium having ampicillin and tetracycline resistance**
A) PBR 322 B) PSC 101 C) BOM D) None of these

29. **Which technique is efficient enough to use only one millionth of the total DNA sample to amplify it:**
A) Recombinant technology B) Gene pharming C) PCR D) Genetic engineering

30. **In PCR after heating for 1 minute to denature DNA, it is cooled for _____ minute to anneal the DNA in PCR:**
A) 1.5 B) 1 C) 2.5 D) 2

31. **In which of the following technique radioactive labeled dNTPs are used?**
A) Sanger's method B) Automated gene sequencing C) Maxam gilbert method D) DNA analysis

32. **The natural enzymes of bacteria which are used for their own protection against viruses are called:**
A) DNA polymerases B) Restricted endonucleases C) DNA ligases D) Reverse transcriptases

33. **Dopamine producing cells can be grafted into the brain of man in order to cure:**
A) Haemophilia B) Epilepsy C) Parkinson's disease D) Colour blindness

34. **A botanist, Steward grew a complete carrot plant in 1958 from a tiny piece of:**
A) Cortex B) Phloem C) Xylem D) Pith

35. **Such DNA molecule is called complementary (cDNA) which is synthesized in laboratory from:**
A) Messenger RNA B) Ribosomal RNA C) Transfer RNA D) Reverse transcriptase

36. **In genetic engineering the plasmid in which gene is incorporated is:**
A) Foreign DNA B) Chromosomal DNA C) Recombinant DNA D) Recombinant plasmid

37. **Children in the SCID syndrome are treated by:**
A) Chemotherapy B) In-vivo gene therapy C) Ex-vivo gene therapy D) Antibiotics

38. **An enzyme that can be used to treat a human lysosome storage disease is:**
A) β-galactosidase B) Glucosidase C) α-galactosidase D) Invertase

39. **The restriction enzymes are called so because they restrict the growth of:**

A) Viruses B) Bacteria C) Viruses and Bacteria D) Microorganisms

40. **Naturally restriction enzymes are found in:**
A) Viruses B) Protists C) Bacteria D) Algae

41. **The principle of PCR is:**
A) Analysis of DNA B) Replication of DNA C) Cloning of DNA D) Isolation of DNA

42. **Patient of cystic fibrosis often die due to numerous infections of the:**
A) Respiratory tract B) Digestive tract C) Nervous system D) Muscular system

43. **Which statement is true?**
A) Plasmids and viruses act as vector
B) Any chromosome can act as vector
C) Only plasmids act as vector
D) Any gene act as vector

44. **The bacterial cells become more permeable to take up recombinant plasmid if they are treated with:**
A) Calcium chloride B) Calcium sulphate C) Calcium carbonate D) Cesium chloride

45. **The meristem of plant is not subjected to the attack of:**
A) Protozoans B) Viruses C) Fungi D) Bacteria

46. **The single stranded but complimentary ends of the DNA molecules are called:**
A) Sticky ends
B) Palindromic sequences
C) DNA ends
D) Flanking end

47. **The natural extra chromosomal circular DNA molecule of a bacterium is a vector called as:**
A) Chimaera B) Clone C) Lambda phage D) Plasmid

48. **DNA analysis is done to:**
A) Diagnose viral infections
B) Identify criminals
C) Determine evolution
D) All of these

49. **A plasmid after insertion of a desired gene (insulin) is called:**
A) Complementary DNA
B) Recombinant DNA
C) Template DNA
D) Extra chromosomal DNA

50. **Polymerase chain reaction was developed by:**
A) Hamilton O Smith
B) Kary B Mullis
C) Maxim Gilbert
D) F – Sanger

51. **Earlier methods of obtaining multiple copies of a specific sequence of DNA were:**
A) Tune consuming
B) Expensive
C) Time consuming and expensive
D) Impractical

52. **PCR is very specific and the targeted DNA sequence can be less than _____ of total DNA sample:**
A) One part in a million
B) One part in a billion
C) Two parts in a million
D) Three parts in a million

53. **Therapeutic and diagnostic proteins are produced by transgenic animals and produced in their:**
A) Urine B) Sweat C) Milk D) Blood

54. **Use of transgenic farm animals to produce pharmacy products is gene:**
A) Forming B) Variation C) Farming D) Pharming

55. **Recombinant DNA is introduced into the host cell by means of a:**
A) Vector B) Fungus C) Bacterium D) Phage

56. **Gel electrophoresis line up the:**
A) DNA fragments B) mRNA fragments C) rRNA fragments D) tRNA fragments

57. **Cumulus cells are those that cling to:**
A) An egg after ovulation occurs
B) An egg before ovulation occurs
C) An ovary after ovulation occurs
D) An ovary before ovulation occurs

58. **Which of the following is correct about SCID?**
A) Common in children as well as in adults
B) It is an immune disorder
C) Is due to deficiency of adenosine diaminase
D) Both b and c

59. **Microscopic vesicles that spontaneously form when lipoproteins are put into a solution, are called:**
A) Liposomes B) Proteosomes C) Nucleosomes D) Mesosomes

60. **A condition that develops when liver cells lack a receptor for removing cholesterol from the blood is cured by:**

A) In vivo gene therapy B) Ex vivo gene therapy C) Transplant surgery D) Chemotherapy

Answers:

1.	A	2.	B	3.	D	4.	B	5.	B	6.	C	7.	B	8.	D	9.	A	10.	C
11.	C	12.	C	13.	A	14.	B	15.	D	16.	B	17.	D	18.	C	19.	B	20.	D
21.	D	22.	A	23.	B	24.	C	25.	B	26.	C	27.	A	28.	A	29.	C	30.	D
31	B	32	B	33	C	34	B	35	A	36	C	37	C	38	C	39	A	40	C
41	B	42	A	43	A	44	A	45	B	46	A	47	D	48	D	49	B	50	B
51	C	52	A	53	C	54	D	55	A	56	A	57	A	58	B	59	A	60	A

ASSESS YOURSELF:

1. **Liposomes are used in gene therapy against:**
   A) Hypercholesterolemia
   B) Coronary artery angioplasty
   C) Cystic fibrosis
   D) Severe combined immuno deficiency syndrome
2. **Genetically engineered cells are introduced into bone marrow cells for the treatment of:**
   A) Hypercholesterolemia
   B) Coronary artery angioplasty
   C) Cystic fibrosis
   D) Severe combined immune deficiency syndrome
3. **The common vector used in recombinant DNA technology are:**
   A) Probes B) Palindromes C) Plasmids D) Prions
4. **The enzyme used to isolate gene from DNA is:**
   A) Helicase
   B) Reverse transcriptase
   C) Restriction enzymes
   D) DNA Polymerase
5. **Which one of the following enzyme is temperature insensitive:**
   A) DNA Polymerase 1
   B) Taq polymerase
   C) DNA Polymerase3
   D) RNA Polymerase
6. **In recombinant DNA technology_____are tools for manipulating DNA:**
   A) Viruses B) Chromosomes C) Enzymes D) Genes
7. **In DNA fingerprinting process, the use of_____products distinctive pattern on autoradiography or X-ray film:**
   A) Restriction enzymes
   B) Micro satellites
   C) Macro satellites
   D)Probes of genetic markers
8. **In recombinant DNA technology plasmids are used as:**
   A) Genetic material B) Enzymes C) Vector D) Probes
9. **In which process multiple copies of the desired gene are produced:**
   A) Polymerase chain reaction
   B) Gene sequencing
   C) Analyzing DNA
   D) DNA fingerprinting
10. **The enzyme adenosine deaminase is missing in persons suffering from:**
    A) Cystic fibrosis
    B) Hypercholesterolemia
    C) Severe combined immune deficiency syndrome
    D) Parkinson's disease
11. **The DNA molecule formed from messenger-RNA by reverse transcriptase is called?**
    A) Complementary DNA
    B) Recombinant DNA
    C) Chimeric DNA
    D) Plasmid DNA
12. **The agent which separates the two strands of DNA in PCR is?**
    A) DNA ligase B) Primer C) Heat D) Helicase
13. **Cystic fibrosis patient lack a gene that codes for trans-membrane carrier of?**
    A) Na^+ ions B) Cl^- ions C) $Ca+^2$ ions D) K^+ ions
14. **The phage commonly used as a vector in genetic engineering is?**
    A) Lambda phage B) Gamma phage C) Alpha phage D) Beta phage
15. **Restriction endonucleases are naturally occurring enzymes of:**
    A) Viruses B) Bacteria C) Fungi D) Plants
16. **pBR 322 Have antibiotic resistant gene for:**
    A) Ampicillin and aspirin
    C) Tetracycline and Ampicillin

B) Streptomycin D) Penicillin

17. **Cystic fibrosis affects which one of the following cells in body:**
A) Epithelial cells B) Endothelial cells C) Plasma cells D) Blood cells

18. **The enzymes which acts as molecular scissors in recombinant DNA technology are:**
A) Exonucleases B) Endonuclease C) Polymerases D) Ligase

19. **Which one of the following is the correct sequence of PCR?**
A) Heating – Cooling - Add primer - Copying of strand
B) Heating-Add primer-Cooling-Copying of strand
C) Add primer-Heating-Cooling-Copying of strand
D) Cooling-Add primer-Heating-Copying of strand

20. **When two different pieces of DNA are joined together, the result is which one of the following?**
A) Complementary DNA C) Recombinant DNA
B) Mutant DNA D) Cloned DNA

21. **Transgenic plants are produced when foreign genes are introduced into:**
A) Mature plant embryo C) Roots
B) Immature plant embryo D) Leaves

22. **Some transgenic bacteria produce a dipeptide sweetener called:**
A) Ultra sweet B) Mono sweet C) Disweet D) NutraSweet

23. **PCR takes its name from:**
A) dNTPs B) DNA polymerase C) Helicase D) Primase

24. **Which vector can clone only a small fragment of DNA?**
A) Bacterial artificial chromosome C) Plasmid
B) Yeast artificial chromosome D) Cosmid

25. **For what purpose is the polymerase chain reaction used?**
A) To amplify DNA B) To clone cells C) To cut DNA D) To join DNA sequences

26. **Tag polymerase is extracted from a bacterium:**
A) Floral aquaticus B) Thermus floral C) Taq aquaticus D) Thermus aquaticus

27. **ADA enzyme lacking disease is:**
A) Cystic fibrosis C) Cancer
B) Familial hyper cholesterol D) SCID

28. **Antithithrombin III, for preventing blood clot during surgery is currently being produced by a herd of:**
A) Buffaloes B) Cows C) Goat D) Sheep

29. **A single stranded nucleotide sequence that will hybridize into a certain piece of DNA is:**
A) Primer B) Probe C) Genome D) Both a & b

30. **Chimaeric DNA is also known as:**
A) Recombinant DNA C) Vector
B) Complementary DNA D) Plasmid

31. **Recombinant DNA contains DNA from:**
A) 2 different sources C) 2 same sources
B) 3 different sources D) 3 same sources

32. **Better medium to collect biotechnology product is:**
A) Sweet B) Milk C) Urine D) Feces

33. **A method of amplification or copying DNA fragments that is faster than cloning is called:**

A) PCR B) DNA sequencer C) Gel electrophoresis D) RFLPS

34. **Which one is a true statement regarding DNA polymerase used in PCR?**
A) It is used to ligate introduced DNA in recipient cells
B) It serves as a selectable marker
C) It is isolated from a virus
D) It remains active at high temperature

35. **Which one has antibiotic resistance gene for tetracycline and ampicillin?**
A) pSC 101 B) pBR 322 C) pCR 322 D) None of these

36. **In which method dideoxyribonucleoside triphosphates are used to terminate DNA synthesis at different site:**
A) Gottlieb's method
B) Maxam Gilbert's method
C) Sangar's method
D) K. B Mullis's method

37. **PCR machine is also known as:**
A) Stabilizer B) Centrifuge C) Autoclave D) Thermocycler

38. **Phenylalanine is an organic chemical needed to a make a dipeptide sweetener known as:**
A) Aspartic acid B) Aspirin C) Ascorbic acid D) Aspartame

39. **A method to produce haploid paints:**
A) Cloning
B) Anther culture technique
C) Tissue culture technique
D) Cell suspension culture technique

40. **First restriction enzyme was isolated by:**
A) Kary Mullis B) Hamilton O. Smith C) Maxam Gilbert D) Hamilton John

41. **For preventing blood clot during surgery, a product produced by transgenic animals is used which is called:**
A) Antithrombin – III B) Prothrombin C) Heparin D) Fibrin

42. **Biotechnology products obtained from bacteria are:**
A) Insulin
B) Human growth hormone
C) Hepatitis B vaccine
D) Insulin, Human growth hormone and Hepatitis B vaccine

43. **Hormone pair required to differentiate the callus:**
A) Auxin & Cytokinin
B) Auxin & Absiccic acid
C) Auxin & Ethylene
D) Cytokinin & Gibberellin

44. **Who said for the first time that plants can be totipotent:**
A) Hamilton O. Smith B) Kary B. Mullis C) Craig J. ventor D) Gottlieb Haberlandt

45. **Due to C4 cycle there is:**
A) More light reaction
B) Continuous photosynthesis
C) Continuous dark reaction
D) Different means of capturing CO_2

46. **PCR and restriction fragment length polymorphism are the methods for:**
A) Study of enzymes
B) Genetic transformation
C) DNA sequencing
D) Genetic fingerprinting

47. **The most important character of an ideal expression system is:**
A) Circular DNA
B) Short generation time & simple genetic system
C) Short generation time
D) Small size

48. _____ Culture are very useful to obtain some drug compound:
A) Callus culture
B) Cell suspension culture
C) Anther culture
D) Meristem culture

49. Autoradiograph is also known as:
A) X-ray imaging
B) UV ray imaging
C) Gamma ray imaging
D) Radioactive imaging

50. Manipulation of DNA in genetic engineering became possible due to the discovery of:
A) Restriction endonuclease
B) DNA ligase
C) Transcriptase
D) Primase

51. Plasmid is:
A) Fragment of DNA which acts as vector
B) A fragment which joins two genes
C) mRNA which acts as carrier
D) Autotrophic fragment

52. DNA fragments generated by the restriction endonucleases in a chemical reaction can be separated by:
A) Centrifugation
B) Polymerase chain reaction
C) Electrophoresis
D) Restriction mapping

53. Gel electrophoresis is used for:
A) Construction of recombinant DNA by joining with cloning vectors
B) Isolation of DNA molecules
C) Cutting of DNA into fragments
D) Separation of DNA fragments according to their size

54. To obtain haploid plant, we culture:
A) Entire anther
B) Embryo
C) Nucleus
D) Apical bud

55. Soma clonal variations are the ones:
A) Caused by mutagens
B) Caused by gamma rays
C) Produce during tissue culturing
D) Induced during sexual embryogeny

56. Which type of primer is used in PCR?
A) DNA Primer
B) Recombinant primer
C) RNA primer
D) Large RNA primer

57. Which of the following is a plasmid?
A) Sall
B) EcoR1
C) BamH1
D) pBR322

58. Taq DNA polymerase synthesizes new DNA strands to the _____ ends of primers:
A) 3'
B) 5' to 3'
C) 5'
D) 5' to 5'

59. Which of the following method is most common to get gene of interest?
A) From messenger RNA
B) Directly cleaved from a chromosomal DNA
C) Synthesized in laboratory
D) From Edna

60. One favorite method to accomplish micro propagation is by:
A) Protoplast culture
B) Cell suspension culture
C) Anther culture
D) Meristem culture

CHAPTER 15

EVOLUTION

COURSE CONTENT

- Theory of natural selection
- Hardy – Weinberg theorem and factors affecting gene / allele frequency

DARWIN & LAMARCKS THEORY OF EVOLUTION

LAMARCK'S THEORY

- **Jean Baptiste Lamarck** (1744-1829) published his theory of evolution in 1809, the year Darwin was born.
- Two important points of **Lamarck's theory are;** use and disuse of organs and inheritance of acquired characters.
- Lamarck argued that those parts of the body used extensively to copy with the environment become larger and stronger e.g. blacksmith developing a bigger biceps in the arm that works the hammer. Similarly, giraffe stretching its neck to new lengths in pursuit of leaves to eat.
- Those parts that are not used deteriorate e.g. loss of legs in snakes due to their habitat of burrows and bushes.
- According to Lamarck, inheritance of acquired characters means that the modifications an organism acquires during its lifetime can be passed along to its offspring e.g. the long neck of giraffe, Lamarck reasoned, evolved gradually as the cumulative product of a great many generations of ancestors stretching higher and higher.

DARWIN'S THEORY OF NATURAL SELECTION

Darwin's observed and collected thousands of specimens of diverse faunas and floras of South America.

His main observations were about fauna and flora of Galapagos Islands where he collected 13 types of finches.

According to Darwin, new species would arise from an ancestral form by the gradual accumulation of adaptations to different environments, separated from original habitat by geographical barriers. Over many generations, the two populations could become dissimilar enough to be designated as separate species.

In 1844 Darwin wrote a long essay on the origin of species and natural selection, his book ***The origin of species*** was published in 1859.

Darwin believed in ***perceived unity in life*** i.e. all organisms related through descent from some common ancestor that lived in the remote past.

According to Darwin, history of life is like a tree, with multiple branching and rebranching from a common trunk all the way to the tips of the living twigs, symbolic of the current diversity of organisms.

- According to Darwin's theory Overproduction > Struggle for Existence > Survival of the Fittest / Natural Selection > Evolution.

EVIDENCES OF EVOLUTION

✓ **BIOGEOGRAPHY**

- It is the geographical distribution of species.
- It was firs evidence that suggested idea of evolution to Darwin.
- According to Darwin, islands have many species of plants and animals that are endemic but closely related to species of the nearest mainland or neighboring island.
- Armadillos (armored mammals) live only in America. The evolutionary view of biogeography predicts that contemporary armadillos are modified descendants of earlier species that occupied these continents and fossil records also confirm existence of such ancestors.

✓ **PALAEONTOLOGY**

- The succession of fossil forms is a strong evidence in favour of evolution.
- It provides a visual record in a complete series showing the evolution of an organism.
- **Fossils** are either the actual remains or traces of organisms that lived in ancient geological times.
- Most fossils are found in **sedimentary rocks.**
- The oldest known fossils are of prokaryotes.
- They show chronological appearance of the different classes of vertebrate animals as shown by fossils. It shows following evolutionary arrangement:
- **Fishes → Amphibians → Reptiles → Mammals + Birds**

✓ **COMPARATIVE ANATOMY**

- Anatomical similarities between species grouped in the same taxonomic category bring another support to the theory of the Descent with modification.

Homologous Structures

- Such organs, which are functionally different but structurally similar are called homologous organs.
- Similarity in characteristics resulting from common ancestry is known as homology and such anatomical signs of evolution are called homologous structures.
- For examples, same skeletal elements make up the forelimbs of human, cats, whales, bats and all other mammals although they have different functions.
- The basic similarity of these forelimbs is the consequence of the descent of all functions.
- The flower parts of a flowering plant are homologous. They are considered to have evolved from leaves, to form sepals, petals, stamens and carpels.
- They are considered to be evolved by **divergent evolution.**

Analogous Structures

- Such organs, which are functionally alike but structurally different, are called analogous organs.
- They are considered to be evolved by **convergent evolution.**
- For example, wings of birds and insects are examples of convergent evolution.
- **Vestigial Structures**
- Such organs, which are historical remnants of structures that had important functions in ancestors but are no longer essential presently are called vestigial organs.
- These are oldest homologous structures.
- For example, skeleton of whales and some snakes retain vestiges of the pelvis and leg bones of walking ancestors, vermiform appendix in carnivores, ear muscles in man etc.

✓ **MOLECULAR BIOLOGY**

- The study of biochemical structures and functions of organisms at molecular level is called molecular biology.
- Evolutionary relationships among species are reflected in their **DNA and proteins,** in their genes and gene products. If two species have genes and proteins with sequences of monomers that match closely, the sequences must have been copied from a common ancestor.
- Molecular biology provides strong evidence in support of evolution as the basis for the unity and diversity of life.

Examples

- **A common genetic code brings evidence that all life is related.**
- **Humans and bacteria have some common proteins.**
- **Cytochrome c, a respiratory protein, is found in all aerobic species.**

HARDY – WEINBERG THEOREM

- The frequencies of genotypes of non-evolving populations are described by Hardy- Weinberg theorem.
- Hardy – Weinberg theorem is named for the two scientists who derived the principle independently in 1908. It states that the frequencies of alleles and genotypes in a population's gene pool remain constant over the generations unless acted upon by agents other than sexual recombination. So shuffling of alleles due to meiosis and random fertilization has no effect on the overall genetic structure of a population.
- A general formula, called the Hardy-Weinberg equation is used for calculating the frequencies of alleles and genotypes in populations at equilibrium.

$p+q=1;$

$$If\ p+q=1, then\ 1-p=q, or 1-q=p$$

P2 +	2pq +	q2 =1
Frequency of AA	Frequency of A a plus aA	Frequency of aa

For our wildflowers, these is 0.64 + 0.32 + 0.04 = 1*

***In fact the Hardy – Weinberg equation is a binomial expansion:** $(p+q)^2\ or\ p^2+2pq+q^2$

FACTORS AFFECTING GENE FREQUENCY

Factor	
Mutation	The ultimate source of all changes; individual mutations occur so rarely that mutation alone does not change allele frequency much.
Migration	A very potent agent of change, migration locally acts to prevent evolutionary change by preventing populations that exchange members from diverging from one another. Emigration and immigration of members of a population, cause disturbance in the gene pool.

Genetic drift.	It is the change in frequency of alleles at a locus that occurs by chance. In small populations, such fluctuations may lead to the loss of particular alleles. This may occur in a small population when a few individuals fail to reproduce and then genes are lost from the population.
Non – random mating	Inbreeding is the most common form; it does not alter allele frequency, but lessens the proportion of heterozyote individuals. Individuals with certain genotypes sometimes mate with one another more commonly than would be expected on a random basis. This is called non – random mating, causing the frequencies of particular genotypes to differ greatly from those predicted by the Hardy – Weinberg principle.
Selection	Some individuals leave behind more progeny than others, and the rate at which they do so is affected by their inherited characteristics. This is called selection. Selection can be artificial selection or natural selection. In artificial selection, the breeders select for the desired characters. In natural selection, the environment plays this role, thus affecting the proportions of gene in a population.

MCQs of EVOLUTION

1. **Origin of species was written by:**
   A) Mendel B) Wallace C) Darwin D) Lamarck
2. **Use and disuse of organs, supports the theory of:**
   A) J.B Lamarck B) Darwin C) Cuvier D) None
3. **Darwin collected how many types of finches on Galapagos:**
   A) 10 B) 12 C) 13 D) 15
4. **Modern theory of synthesis is called:**
   A) Darwinism B) Neo Darwinism C) Lamarckism D) None
5. **C. Darwin died in the year:**
   A) 1866 B) 1881 C) 1882 D) 1902
6. **Penguin is a bird that lost the use of its wings by not flying. Such statement would express the views of:**
   A) Darwin B) Wallace C) Lamarck D) Huxley
7. **Evolution is defined as:**
   A) History of race
   B) Development of race
   C) History and development of race with variations
   D) Progressive history of race
8. **Darwin's theory, as presented in the Origin of Species, is mainly concerned with:**
   A) How new species arise C) The origin of life
   B) How adaptations are inherited D) How extinctions occur
9. **Which type of struggle for existence is more challenging:**
   A) Intra-specific B) Inter-specific C) Among communities D) None of these
10. **Galapagos Islands visited by Darwin are near:**
    A) South America B) Australia C) South Africa D) Europe
11. **_____ refers to the processes that have transformed life on earth from its earliest forms to the vast diversity that we observe today:**
    A) Evolution B) Catastrophism C) Random mating D) New-Darwinism
12. **Charles Darwin was:**
    A) Evolutionist B) Naturalist C) Creationist D) Both a & b
13. **Which of these represent the tip of evolutionary tree which Darwin explained in "Descent with modification":**
    A) Man B) Cow C) Angiosperms D) All
14. **Neo Darwinism was developed in early:**
    A) 1920s B) 1930s C) 1940s D) None
15. **The fossil remains of archaeopteryx shows characteristics of:**
    A) Amphibians B) Reptiles and Birds C) Fish and amphibians D) Reptiles and mammals
16. **Existence of coal can be explained by:**
    A) Ecology B) Botany C) Paleontology D) Bacteriology
17. **In human body all the following organs are vestigial, except:**
    A) Nictitating membrane C) Muscles
    B) Appendix D) Coccyx

18. **The presence of notochord, gill slits and dorsal hollow central nerve tube are the characteristic features of:**
A) Parazoa B) Chordates C) Invertebrate D) All the animals

19. **What is the correct sequences of fossils found?**
A) Fishes-mammals-reptiles-birds
B) Fishes-birds-amphibians-reptiles
C) Mammals-reptiles-amphibians-fishes
D) Mammals-reptiles-fishes-amphibian

20. **Divergent evolution is represented by**
A) Vestigial organs B) Analogous organs C) Homologous organs D) both a and b

21. **Which of the following is not vestigial?**
A) Ear muscle in man B) pelvis of whales C) Legs of snakes D) beak of birds

22. **Eukaryote and prokaryotes are similar due to all biomolecules, except**
A) Same genetic code
B) Cytochrome c
C) DNA as Genetic material
D) Extra chromosomal DNA

23. **In a population of 50 people, 40 died due to earth quack the reaming 10 have altered allelic frequencies this effect is**
A) Natural selection B) Genetic Drift C) Migration D) both a and b

24. **For keeping genotype frequencies constant what condition should be met**
A) Non-random mating in population
B) Genetic Drift
C) Immigration
D) Sexual reproduction (Random)

25. **One source of evidence for evolution is _____. This source is the study of the distribution of organisms around the world and helps explain why animals on different continents are often very different even through their environments are similar. It also explains why fossils of animals now living in Africa occur in South America.**
A) Paleontology B) Comparative anatomy C) Biogeography D) Molecular biology

26. **Which of the following believed in theory of special creation?**
A) Lamarck B) Lyell C) Darwin D) Linnaeus

27. **The deepest strata of the earth contains fossils that are:**
A) Old and complex B) Old and simple C) Young and complex D) Young and simple

28. **Which of the following gives the correct order for the evolution of vertebrates?**
A) Fish, reptiles, mammals, amphibians
B) Reptiles, fish, mammals, amphibians
C) Amphibians, reptiles, fish, mammals
D) Fish, amphibians, reptiles, mammals

29. **When the Mendelism and Darwinism were reconciled?**
A) 1930s B) 1940s C) 1920s D) 1950s

30. **It provides a visual record in a complete series showing the evolution of an organism:**
A) Biogeography B) Molecular biology C) Comparative anatomy D) The fossil record

31. **According to Hardy Weinberg's theorem what will be the value of heterozygous individuals when the value of recessive allele in population is 0.30:**
A) 0.49 B) 0.42 C) 0.09 D) 0.32

32. **The total aggregate of genes in a population at any one time is called population's:**
A) Genome B) Genomic library C) Genetic group D) Gene pool

33. **In humans gill pouches have modified into:**
A) Nose B) Ear C) Eustachian tubes D) External ear

34. **Hardy Weinberg theorem describes the frequencies of genotypes of:**
A) Non evolving populations
B) Evolving populations
C) Non evolving individuals
D) Evolving individuals

35. **Forelimb of human, cats, whales, bats and all other mammals are examples of:**
A) Appendages with similar functions
B) Analogous organs
C) Convergent evolution
D) Homologous organs

36. **This may occur in small populations:**
A) Immigration B) Emmigration C) Genetic drift D) Mutation

37. **Production of more individuals, than the environment can support leads to a:**
A) Struggle for existence B) Survival of the fittest C) Evolution D) Adaptations

38. **The oldest known fossils are:**
A) Plants B) Prokaryotes C) Animals D) Vertebrates

39. **A respiratory protein found in all aerobic species is:**
A) Plastocyanin B) Ferredoxine C) Cytochrome f D) Cytochrome C

40. **Scientist who was first argued evolution with evidence?**
A) Aristotle B) Darwin C) Mendel D) Lamarck

Answers:

1.	C	2.	A	3.	C	4.	B	5.	C	6.	C	7.	C	8.	A	9.	A	10.	A
11.	A	12.	A	13.	D	14.	B	15.	B	16.	C	17.	B	18.	B	19.	B	20.	C
21.	D	22.	D	23.	B	24.	D	25.	C	26.	D	27.	B	28.	D	29.	A	30.	D
31	B	32	D	33	C	34	A	35	D	36	C	37	A	38	B	39	D	40	B

ASSESS YOURSELF

(EVOLUTION)

1. **The greatest weakness (demerit) in Darwinism was its failure to explain the cause of:**
   A) Variations
   B) Struggle for existence
   C) Over production
   D) Survival for fittest
2. **Who hypothesized that organism evolved through the inheritance of acquired characteristics?**
   A) Darwin B) Lamarck C) Aristotle D) Linnaeus
3. **Which of the following theories of evolution can best explain vestigial organs?**
   A) Lamarckism B) Darwinism C) Natural selection D) Special creation
4. **The structures which are reduced during the course of evolution and have no apparent functions are called:**
   A) Regenerated organs
   B) Analogous organs
   C) Vestigial organs
   D) Useless organs
5. **It provides a visual record in a complete series showing the evolution of an organism:**
   A) Biography
   B) The fossil record
   C) Comparative anatomy
   D) Molecular biology
6. **The evolution of _____ provides an example of history of vertebrate descent:**
   A) Sheep B) Horse C) Elephant D) Dinosaur
7. **They show chronological appearance of the different classes of organisms:**
   A) Fossils
   B) Homologous structures
   C) Analogous structures
   D) Comparative anatomy
8. **They show chronological appearance of the different classes of organisms:**
   A) Fossils
   B) Homologous structures
   C) Analogous structures
   D) Comparative anatomy
9. **Analogous organs show:**
   A) Convergent evolution
   B) Divergent evolution
   C) Straight evolution
   D) Zig-zag evolution
10. **Similarity suggests**
    A) Evolution B) Variety C) Mutation D) Common ancestry
11. **One of the following is incorrect about Lamarck's theory:**
    A) Use of organs
    B) Disuse of organs
    C) Acquired characters are inherited
    D) All of them
12. **Which of the following is considered to be a human "vestigial" structure?**
    A) Appendix B) Legs C) Pelvis D) Eye brows
13. **Pick the odd one out:**
    A) Genetic variations
    B) Genetic recombination
    C) Crossing over
    D) Mutation
14. **Which of the following is not related to divergent evolution?**
    A) Human hand, bat's wing
    B) Horse front leg, cat's paw
    C) Cactus, euphorbia
    D) Red fox and kit fox
15. **The title of Darwin's book published in 1859 was:**
    A) Origin of species by means of Natural selection
    B) Over production
    C) Survival for fittest
    D) Struggle for existence
16. **The occurrence of ATP as the reservoir of energy for all organisms is an example of evolution from:**
    A) Molecular biology B) Embryology C) Biochemistry D) Anatomy
17. **Darwin collected on Galapagos _____ kinds of finches**
    A) 13 B) 15 C) 14 D) 12
18. **Wallace developed a theory of natural selection essentially identical to:**
    A) Lamarck B) Darwin C) Linnaeus D) Hutton

19. **Homologous organs show:**
A) Straight evolution
B) No relation to evolution
C) Convergent evolution
D) Divergent evolution

20. **The structures which are reduced during the course of evolution and have no apparent functions are called?**
A) Regenerated organs B) Analogous organs C) Vestigial organs D) Useless organs

21. **In hardy Weinberg if the population of homozygotes are 16% what will be percentage of heterozygote?**
A) 60% B) 36% C) 84% D) 70%

22. **Long neck of giraffe evolved gradually as a product of a great many generation of ancestors stretching higher and higher**
A) Degenerative B) Cumulative C) Subtracted D) Progressive

23. **Structures found in different species which are believed to have a common evolutionary origin are called:**
A) Homologues B) Analogous C) Vestigial D) Fossilized

24. **When two unrelated animals adapt to similar conditions and superficial structural similarities result, _____ evolution has occurred:**
A) Parallel B) Homologous C) Divergent D) Convergent

25. **Evolutionary processes have resulted in approximately _____ million species, of which 1.4 million species have been described:**
A) 2 B) 3 C) 4-30 D) 100

26. **Most fossils are found in:**
A) Igneous rocks B) Metamorphic rocks C) Sedimentary rocks D) Bare rocks

27. **Ideas concerning the theory of organic evolution were published and supported with convincing evidence by Charles Darwin in _____:**
A) 1602 B) 1750 C) 1859 D) 1923

28. **In a population with two alleles for a particular locus B, b the allele frequency of B is 0.7. What is the frequency of homozygous recessive if the population is at Hardy-Weinberg equilibrium?**
A) 0.9 B) 0.49 C) 0.42 D) 0.21

29. **The oldest homologous structures are?**
A) Vestigial organs B) Analogous organs C) Rudimentary organs D) Organs of marginal use

30. **Which one of the following is considered as strong evidence of evolution?**
A) Embryology Record B) Molecular Record C) Biochemical Record D) Fossil Record

31. **The structures which are reduced during the course of evolution and have no apparent function are called:**
A) Regenerated organs B) Vestigial organs C) Saltatory organs D) Useless organs

32. **Adaptations that an organism acquires are:**
A) Heritable B) Homogeneous C) Not heritable D) All of these

33. **If the frequency of allele B is 40% then the frequency of allele b is _____ according to hardy Weinberg theorem:**
A) 0.4 B) 0.6 C) 0.8 D) 0.2

34. **Darwin's theory as presented in "The origin of Species" mainly concerned:**
A) How new species arise
B) How adaptations evolve
C) The origin of life
D) The genetics of evolution

35. **Adaptations that an organism acquires by its own actions are:**
A) Heritable
B) Can be made heritable through some modifications
C) Not heritable
D) Both heritable and not heritable

36. **Who developed a theory of natural selection essentially identical to Darwin's?**
A) Hardy-Weinberg B) Malthus C) Alfred Wallace D) Lyell

37. **Two structures that are similar because of common ancestry are _____:**
A) Analogous B) Comparative C) Homologous D) None of the above is correct.

38. **Darwin's theory of natural selection is identical to idea of evolution given by:**
A) Malthus B) Mendel C) Wallace D) Lamarck

39. **Change of frequency of alleles at a locus that occurs by chance is:**
A) Migration B) Genetic drift C) Gene flow D) Gene frequency

40. **The human gill pouches develop into:**
A) Middle ear B) Eustachian tube C) Trachea D) Vocal cords

CHAPTER 16

PAST PAPER SERIES

ENTRANCE TEST – 2008

BIOLOGY

1. **Which of the following receptors produce sensation of pain?**
   A) Mechanoreceptor.
   B) Nociceptors.
   C) Chemoreceptors.
   D) Thermoreceptors.
2. **When your finger accidentally gets caught in a door, the pain message is sent to your brain through____.**
   A) Homeostasis.
   B) Sensory receptors.
   C) Caffeine.
   D) The medulla.
3. **Neck has___type of joint.**
   A) Ball and socket.
   B) Pivot.
   C) Hinge.
   D) Fibrous.
4. **End product of hemoglobin break down is:**
   A) Creatinine.
   B) Bilirubin.
   C) Hypoxanthin.
   D) Xanthin.
5. **In what direction, can a DNA polymerase work when catalyzing the addition of nucleotide monomers to build a strand of DNA?**
   A) From the 5' toward the 3' end of the new strand being assembled.
   B) From the replication centers in two directions called replication forks.
   C) From the 3' to the 5' end of the strand being assembled.
   D) In both directions if DNA ligase is present.
6. **Which bond is the potential source of chemical energy for cellular activities?**
   A) C-N.
   B) C-O.
   C) C-H.
   D) H-O.
7. **Sharks and rays are included in class:**
   A) Cyclostomata.
   B) Chondrichthyes.
   C) Osteichthyes.
   D) Tetrapoda.
8. **In what stage of aerobic respiration are 2-carbon molecules oxidized completely to carbon dioxide?**
   A) Glycolysis.
   B) ETC.
   C) Krebs cycle.
   D) Calvin cycle.
9. **Which of the following does not have specialized respiratory organs?**
   A) Hydra.
   B) Birds.
   C) Cockroach.
   D) Both A and B.
10. **Humming birds belong to the category**
    A) Heterotherms.
    B) Endotherms.
    C) Ectotherms.
    D) None of these.
11. **Syphilis is caused by**
    A) Neisseria gonorrhoeae.
    B) Cats worm.
    C) Treponema pallidum.
    D) Herpes simplex.
12. **In moths' male is __**
    A) Heterogametic.
    B) Dieogametic.
    C) Homogametic.
    D) Both B and C.
13. **When carbon dioxide pressure increases the capacity of haemoglobin to hold oxygen:**

A) Increases many folds.
B) Decreases.
C) Remains constant.
D) Is doubled.

14. **The soluble part of the cytoplasm is termed as**
A) Cisternae.
B) Cytosol.
C) Endocytosis.
D) Both A and B.

15. **Name the enveloped RNA virus that causes infusion hepatitis.**
A) HBV.
B) HAV.
C) HCV.
D) None of these.

16. **In general, asexual reproduction is common in**
A) Humans.
B) Basidiomycota.
C) Deuteromycota.
D) Basidiospores.

17. **Name the vertebrates which are without jaws.**
A) Osteichthyes.
B) Cyclostomata.
C) Chondrichthyes.
D) None of these.

18. **The total inside capacity of lungs of adult human beings when fully inflated is**
A) 5 ml.
B) 50 ml.
C) 500 ml.
D) 5000 ml.

19. **Which of the following belong to collenchyma cells?**
A) Fibers.
B) Vessels.
C) Sclereides.
D) None of these.

20. **Which of the following promotes both leaf and fruit growths?**
A) Auxins.
B) Gibberellins.
C) Abscisic acid.
D) Ethane.

21. **Name the external factor of growth in plants**
A) Carbon dioxide.
B) Water.
C) Hormones.
D) Nutrition.

22. **The genes of blue opsin are present on**
A) Autosome 9.
B) Autosome 7.
C) Autosome 1.
D) Autosome 3.

23. **The dew drops on tips of grass leaves is an example of**
A) Infestation.
B) Bleeding.
C) Exudation.
D) Imbibition.

24. **Which of the following modifies proteins and lipids by adding carbohydrates?**
A) Golgi Apparatus.
B) Polysome.
C) Plasma membrane.
D) None of these.

25. **Which of the following are spiral-shaped bacteria?**
A) Cocci.
B) Bacilli.
C) Pseudomonas.
D) Vibrio.

26. **Which of the following is used for lowering blood cholesterol?**
A) Neurospora.
B) Griseofulvin.
C) Aspergillus.
D) Lovastatin.

27. **Which of the following are called placental mammals?**
A) Prototheria.
B) Eutheria.
C) Metatheria.
D) All of these.

28. **The attraction among water molecules which hold water together is called**
A) Tension.
B) Adhesion.
C) Cohesion.
D) Imbibition.

29. **Pick the paratonic movement from the following**
A) Nastic.
B) Turgor.
C) Growth.
D) Tactic.

30. **It controls the several automatic functions like breathing, heart rate and blood pressure:**
A) Midbrain.
C) Medulla.

B) Pons. D) Cerebellum.

31. **Which of the following has 40 chromosomes?**
A) Corn. C) Frog.
B) Sugarcane. D) Mouse.

32. **The cell suspension culture of____produces quinine.**
A) Soybean. C) Digitalis lanata.
B) Cinchona ledgeriana. D) Luceferin.

33. **Which one of the following is most slender in structure?**
A) Microtubules. C) Intermediate filaments.
B) Micro filaments. D) Both A and B.

34. **Name the human tissues that contain about 85% water.**
A) Nerve cells. C) Brain cells.
B) Bone cells. D) None of these.

35. **Which of the following are colorless?**
A) Chloroplasts. C) Leucoplasts.
B) Chromoplasts. D) None of these.

36. **Name the one involved in DNA replication.**
A) Cysts. C) Ribosomes.
B) Mesosomes. D) Spores.

37. **Which of the following has rootless sporophytes?**
A) Psilopsida. C) Lycopsida.
B) Tracheophyta. D) Sphenopsida.

38. **Chlorophylls absorb mainly_____ wave length.**
A) Yellow. C) Violet-blue.
B) Green. D) Indigo.

39. **_____ did not have the adaptations to remove the flooding of their cells in fresh water.**
A) Both B, D. C) None of B, D.
B) Hydrophytes. D) Xerophytes.

40. **Which of the following is made up of bones and cartilage?**
A) Endoskeleton. C) Hydrostatic skeleton.
B) Exoskeleton. D) Both A and B.

41. **This disease is characterized by the decline in brain function.**
A) Alzheimer's disease. C) Epilepsy.
B) Parkinson's disease. D) None of these.

42. **Prophase, metaphase and telophase are subdivisions of**
A) Mitosis. C) Cytokinesis.
B) Karyokinesis. D) None of these.

43. **_____ organs are functionally different but structurally alike.**
A) Analogous. C) Homologous.
B) Unilogous. D) Hypologous.

44. **Which of the following gives blue color with iodine?**
A) Starch. C) Glycogen.
B) Cellulose. D) All of these.

45. **Herpes simplex is caused by_____ virus.**
A) Enveloped RNA. C) DNA virus
B) RNA tumor. D) Both B and C.

46. **Name the cyanobacteria which are helpful in fixing atmospheric nitrogen.**
A) Heterocysts. C) Akinetes.
B) Nostoc. D) Hormogonia.

47. **Name the class that contains seedless plants.**
A) Angiospermae. C) Paraphsys.
B) Gemnospermae. D) Filicineae.

48. **Which form of anaerobic respiration occurs in muscle cell of humans and other animals**

during extreme physical activities?
A) Alcoholic fermentation.
B) Lactic acid fermentation.
C) Glycolysis.
D) Pyruvic acid oxidation.

49. How much water approximately is required to excrete 1 kg of ammonia nitrogen?
A) 500 ml.
B) 5 litre.
C) 300 litre.
D) 500 litre.

50. Which disease causes immobility and fusion of vertebral joint?
A) Sciatica.
B) Spondylosis.
C) Disc slip.
D) Rickets.

51. Which hormone continues to promote protein synthesis throughout the body even after the cease in growth?
A) TSH.
B) ADH.
C) ACTH.
D) STH.

52. Position of a gene on the chromosome is called its
A) Phenotype.
B) Locus.
C) Junction.
D) Genotype.

53. Pick the biotic component from the following.
A) Soil.
B) Water.
C) Atmosphere.
D) Animals.

54. The two strands in DNA are coiled_____to each other.
A) Parallel.
B) Antiparallel.
C) Both A, B.
D) None of these.

55. Name the class without antennae.
A) Arachnida.
B) Myriapoda.
C) Insecta.
D) Crustacea.

56. The African sleeping sickness is caused by _____
A) Entamoeba histolytica.
B) Trypanosoma.
C) Zooflagellates.
D) Ciliates.

57. Which of the following does not belong to angiospermic families?
A) Picea.
B) Poaceae.
C) Rosaceae.
D) Fabaceae.

58. Name the nutrition resulted by feeding on dead and decaying matter.
A) Saprophytic.
B) Parasitic.
C) Symbiotic.
D) Both B and C.

59. How many grams of nitrogen can be eliminated in form of uric acid by 50 ml of water?
A) 20.
B) 25.
C) 30.
D) 50.

60. Which disease is caused by low calcium in the blood?
A) Tetany.
B) Cramp.
C) Muscle fatigue.
D) Sciatica.

61. It is known that red light__flowering in the long day plants.
A) Synchronizes.
B) Inhibits.
C) Promotes.
D) Does not affect.

62. The colour phenotype of the grain is the sum of individual effects of__alleles.
A) Six.
B) Five.
C) Four.
D) Five or three.

63. In___zone the light is insufficient to support photosynthesis.
A) Desert.
B) Profundal.
C) Littoral.
D) All of these.

64. The optimum temperature for enzymes of human body is
A) 32 ^{o}F.
B) 46 ^{o}C.
C) 313 K.
D) 37 ^{o}C.

65. **Which of the following damages wooden ships?**
A) Sepia.
B) Limax.
C) Teredo.
D) Ostrea.

66. **Which of the following may build coral reefs along with coral animals?**
A) Myxomycota.
B) Brown algae.
C) Green algae.
D) Red algae.

67. **Which of the following do not have a body cavity?**
A) Pseudocoelomata.
B) Acoelomata.
C) Coelomata.
D) None of these.

68. **Name the neurotic disorder characterized by bouts of over eating of fattening foods.**
A) Bulimia nervosa.
B) Dyspepsia.
C) Anorexia nervosa.
D) Salmonella.

69. **Which one of these is an example of tubular excretory system called metanephridia?**
A) Planaria.
B) Hydra.
C) Cockroach.
D) Earthworm.

70. **Name the human tissues that contain about 85% water**
A) Nerve cells.
B) Bone cells.
C) Brain cells.
D) None of these.

Answers :

1.	B	2.	B	3.	B	4.	B	5.	B	6.	A	7	B	8.	C	9.	A	10.	A
11	C	12	C	13	B	14	B	15	C	16	C	17	B	18	A	19	D	20	B
21	A	22	B	23	C	24	A	25	D	26	D	27	B	28	C	29	A	30	C
31	D	32	B	33	D	34	C	35	C	36	B	37	A	38	C	39	B	40	A
41	A	42	B	43	C	44	A	45	C	46	A	47	D	48	B	49	D	50	D
51	D	52	B	53	D	54	B	55	A	56	B	57	A	58	A	59	D	60	A
61	C	62	A	63	B	64	D	65	C	66	D	67	B	68	A	69	D	70	C

ENTRANCE TEST – 2009

BIOLOGY

1. **If DNA strand is GCTATGG mRNA strand synthesized from it would be:**
   A) CGAUACC
   B) CGTATGC
   C) CGATACC
   D) CGUTCC

2. **Which one of the following conditions best describes active membrane potential:**

   A) + + + + + + + + + + Outside
   – – – – – – – – – – –
   Inside Neuron

   C) + – + – + – + – + – + Otside
   + – + – + – + – + – +
   Inside Neuron

   B) + + + + + + + + + + + Outside
   + + + + + + + + + + +
   Inside Neuron

   D) – – – – – – – – – – – Outside
   + + + + + + + + + + +
   Inside Neuron

3. **Tissue rejection is executed by:**
   A) Both B and T lymphocytes
   B) Monocytes
   C) B-lymphocytes
   D) T-lymphocytes

4. **Which of the following statement best describes the function of sinoatrial node?**
   A) It sends out electrical impulses to ventricles to contract.
   B) It is present at upper end of the left atrium
   C) It consists of small number of diffusely oriented cardiac fibers.
   D) It sends out electrical impulses to atrial muscles causing both atria to contract.

5. **A central cavity of the kidney where urine is collected after filtration is known as:**
   A) Ureter
   B) Pelvis
   C) Urethra
   D) Urinary Bladder

6. **Aldosterone plays role in:**
   A) Transport of water
   B) Transport of K^+ ions into kidney
   C) Uptake of sodium in loop of Henle
   D) Reabsorption of water

7. **Technique used for non-surgical removal of kidney stone is called:**
   A) Ultrasound
   B) Lithotripsy
   C) Dialysis
   D) X-ray

8. **Microcephaly, the small sized skull is due to:**
   A) Nutritional Cause
   B) Skeleton Damage
   C) Hormonal Causes
   D) Genetic Defect

9. **The joints that allow movements in several directions are:**
   A) Hinge Joints
   B) Ball and Socket Joints
   C) Fibrous Joints
   D) Cartilaginous Joints

10. **The collagen fibers of bone are hardened by deposit of:**
    A) Calcium phosphate
    B) Calcium oxalate
    C) Calcium carbonate
    D) Calcium bicarbonate

11. **Which of the following neurotransmitters lies outside the central nervous system?**
    A) Serotonin
    B) Dopamine
    C) Acetylcholine
    D) Adrenaline

12. **Which hormonal pair shares a common hypothalamic releasing factor?**
    A) STH and LH
    B) ACTH and LH
    C) FSH and STH
    D) FSH and LH

13. **Which of the following will happen if fertilization does not occur?**
    A) Menopause starts
    B) Corpus luteum degenerates
    C) FSH secretion is increased
    D) Progesterone secretion is increased

14. **Newborn infant may acquire serious eye infections, if his/her mother has:**

A) Genital herpes
B) AIDS
C) Gonorrhea
D) Syphilis

15. **At the cephalic end of primitive streak, closely packed cells form a local thickening known as:**
A) Henson's Node
B) Gastrocoele
C) Primitive Ridge
D) Primitive Gut

16. **In plants, the red light favours:**
A) Enhancement of cell differentiation
B) Elongation of cells
C) Maturation of the cells
D) Enhancement of cell division

17. **The reaction between the phosphate group of one nucleotide and hydroxyl group of another is a_synthesis in DNA molecule.**
A) Dehydration
B) Rehydration
C) Oxidation
D) Reduction

18. **Enzyme which attaches the Okazaki fragments in lagging strand is called:**
A) Restriction endonuclease
B) Primase
C) DNA helicase
D) DNA ligase

19. **In phenylketonuria, phenylalanine is not degraded because of defective enzyme:**
A) Phenylalanine hydrogenase
B) Phenylalanine phosphate
C) Phenylalanine oxidase
D) None of these

20. **Males with XXY chromosomes suffer from:**
A) Klinefelter's Syndrome
B) Jacob's Syndrome
C) Down's Syndrome
D) Edward's Syndrome

21. **Internal program of events and sequences of morphological changes by which cell commit a suicide is collectively called:**
A) Necrosis
B) Epistasis
C) Metastasis
D) Apoptosis

22. **Phragmoplast is formed from vesicle which originates from:**
A) Smooth Endoplasmic Reticulum
B) Golgi Complex
C) Ribosome
D) Rough Endoplasmic Reticulum

23. **When phenotype of a heterozygote is in between the phenotypes of both the homozygote parents, it is called:**
A) Incomplete dominance
B) Epistasis
C) Pleiotropy
D) Codominance

24. **Which one of correct about 'Rh^{+}' blood?**
A) Will produce anti-Rh antibodies if given Rh^{+} blood
B) Cannot produce anti-Rh antibodies in any case
C) Rh^{+} antigens are present on RBCs
D) Rh^{+} antibodies are present in blood

25. **Temperature-insensitive (thermostable) enzyme used in PCR is:**
A) DNA polymerase I
B) DNA polymerase III
C) DNA ligase
D) Taq polymerase

26. **Cloning is a form of:**
A) Parthenogenesis
B) Apomixis
C) Sexual Reproduction
D) Asexual Reproduction

27. **Antigens to treat Non-Hodgkin's lymphoma are produced by:**
A) Wheat Plant
B) Rice Plant
C) Tobacco Plant
D) Corn Plant

28. **The survival of an organism during the struggle for existence is not random, but depends on:**
A) Its genetic constitution
B) Its ability to acquire characters
C) Its ability to over-produce
D) Its ability to over-eat

29. **Evolutionary relationships amongst species are reflected in their:**
A) DNA and proteins
B) RNAs and proteins
C) DNA and gene
D) DNA and RNAs

30. **If all the members of a population are homozygous for the same allele, that allele is said to be:**
A) Random in population's pool
B) Fixed in population's pool
C) Random in a species
D) Fixed in the gene pool

31. **Diseases in living organisms which are caused by parasites are called:**
A) Disinfestations
B) Antisepsis
C) Infections
D) Infestations

32. **The nutrient cycles are also called:**
A) Biogeochemical cycles
B) Biochemical cycles
C) Bio element cycles
D) Geochemical cycles

33. **The productivity of aquatic ecosystem is determined by:**
A) Water
B) Light and nutrients
C) Light
D) Nutrients

34. **What is the drawback of nuclear energy?**
A) It causes radiation pollution
B) It is not long lasting
C) It is very expensive
D) It pollutes the air

35. **Arteriosclerosis is:**
A) A metabolic disorder
B) A degenerative Disorder
C) An infectious disorder
D) A nutritional deficiency disorder

36. **Antibiotics act against:**
A) Bacterial Diseases
B) Allergies
C) Bacterial and Viral Diseases
D) Viral Diseases

37. **Immediate source of energy for cellular metabolism is:**
A) Lipids
B) ATP
C) Carbohydrates
D) Proteins

38. **Haemoglobin exhibits:**
A) Secondary Structure
B) Primary Structure
C) Quaternary Structure
D) Tertiary Structure

39. **Pepsin enzyme is produced in an inactive form and is activated in situation when it is required because:**
A) Not produced in complete form
B) Quite capable of destroying cells internal structure
C) It does not work efficiently at that time
D) None of the above

40. **Enzyme after catalysis detaches itself from the product:**
A) Completely
B) Incompletely
C) Changed
D) Unchanged

41. **A group of ribosomes attached to messenger RNA is known as:**
A) Ribosome
B) Lysosome
C) Nucleosome
D) Polysome

42. **Detoxification of harmful drugs within the cell is done by:**
A) Nucleolus
B) Smooth Surface Endoplasmic Reticulum
C) Ribosomes
D) Food Vacuoles

43. **Tay-Sach's disease is due to the presence of an enzyme that is inverted in the catabolism of:**
A) Proteins
B) Carbohydrates
C) Ascorbic Acid
D) Lipids

44. **What is true about pattern baldness?**
A) It is autosomal recessive disease in males
B) It is autosomal dominant disease in males
C) It is X-linked disease
D) It is Y-linked disease

45. **Symptoms of Herpes Simplex is:**
A) Abdominal Pain
C) Vesicular lesions in the epithelial layer

B) Fever
D) Failure of immune system

46. **The major cell infected by the HIV is:**
A) Leucocyte
B) Monocyte
C) Helper T-lymphocyte
D) B-lymphocyte

47. **_____ are used as important vectors in genetic engineering.**
A) Ribosomes
B) Plasmids
C) Nucleoids
D) Mesosomes

48. **Which of the following is aerobic bacterium?**
A) Spirochete
B) Cyanobacteria
C) E. coli
D) Pseudosomanas

49. **The giant amoebas inhabit mud at the bottom of fresh water ponds and obtain energy from:**
A) Microscopic bacteria
B) Aerobic bacteria
C) Anaerobic bacteria
D) Methanogenic bacteria

50. **A large group of parasitic protozoa, some of which causes various diseases such as malaria to humans, are:**
A) Aschelminthes
B) Platyhelminthes
C) Annelida
D) Arthropods

51. **Penicillin is obtained from:**
A) Penicillium notatum
B) Aspergillus flavus
C) Aspergillus fumigatus
D) Penicillium chrysogenum

52. **Which of the following components is less resistant to decay?**
A) Lignin
B) Starch
C) Chitin
D) Cellulose

53. **_____ are bioindicators of air pollution.**
A) Cyanobacteria
B) Fungi
C) Mycorrhiza
D) Lichens

54. **The gymnosperms are called 'Naked Seeded' plants because they bear naked:**
A) Antheridia
B) Ovules
C) Fruits
D) Archegonia

55. **The integumented indehiscent mega sporangium is called:**
A) Seed
B) Megagametophyte
C) Archegonium
D) Ovule

56. **Pulses are present in the family:**
A) Caesalpinlaceae
B) Fabaceae
C) Gramineae
D) Mimosaceae

57. **It is an endoparasite of humans, cattle and pig that completes its life cycle in two hosts:**
A) Tapeworm
B) Aurelia
C) Liver fluke
D) Planaria

58. **Tse-tse fly causes the sleeping sickness and skin diseases by transmitting:**
A) Plasmodium
B) Trypanosoma
C) Anopheles
D) Insects

59. **Coelem is a cavity lined by:**
A) Mesoderm
B) Endoderm
C) Epiderm
D) Ectoderm

60. **Which of the following molecules is reduced by accepting hydrogen in Calvin Cycle?**
A) Glyceraldehyde-3-phosphate
B) Ribulose bisphosphate
C) 3-Phosphoglycerate
D) 1,3-Bisphosphoglycerate

61. **The molecule formed after first phosphorylation during glycolysis is:**
A) Fructose-6-phosphate
B) Fructose-1, 6-bisphosphate
C) Glucose-1-phosphate
D) Glucose-6-phosphate

62. **Krebs Cycle in mitochondria takes place in:**
A) Cytosol
B) Matrix
C) Outer Membrane
D) Inner Membrane

63. **At the junction between esophagus and the stomach there is a special ring of muscles called:**
A) Cardiac Sphincter
B) Ileocolic Sphincter
C) Esophageal Sphincter
D) Pyloric Sphincter

64. **Hepatic and pancreatic secretions are also stimulated by a hormone called:**
A) Gastrin
B) Secretin
C) Insulin
D) Glucagon

65. **Like pepsin, trypsin is also secreted as inactive trypsinogen, which is activated by:**
A) Enterokinase
B) Lipase
C) Chyme
D) Erypsin

66. **During photorespiration, the glycolate is converted into glycine in a structure of cell called:**
A) Golgi Bodies
B) Glyoxisome
C) Mitochondria
D) Peroxisome

67. **The respiratory pigment, which has much higher affinity to combine with oxygen, is:**
A) Myoglobin
B) Globin
C) Haemoglobin
D) Hemocyanin

68. **Most of the carbon dioxide is carried in the blood in the form of:**
A) Bicarbonate
B) Carboxyhemoglobin
C) CO_2
D) Blood plasma protein

69. **Antibiotics are actually:**
A) Globular proteins
B) Glycoproteins
C) Fibrous proteins
D) Glycolipids

70. **Heparin prevents blood clots and is released by:**
A) Eosinophils
B) Monocytes
C) Neutrophils
D) Basophils

Answers :

1.	C	2.	A	3.	D	4.	D	5.	B	6.	C	7	B	8.	D	9.	B	10.	A
11	C	12	D	13	B	14	C	15	A	16	B	17	A	18	D	19	C	20	B
21	D	22	B	23	A	24	A	25	D	26	D	27	C	28	A	29	A	30	D
31	D	32	A	33	B	34	A	35	B	36	A	37	B	38	C	39	B	40	D
41	D	42	B	43	D	44	B	45	C	46	C	47	B	48	D	49	D	50	A
51	A	52	C	53	D	54	B	55	D	56	B	57	A	58	B	59	A	60	D
61	D	62	B	63	A	64	B	65	A	66	D	67	A	68	A	69	A	70	D

ENTRANCE TEST 2010

BIOLOGY

1. **Book lungs are present in arthropods for exchange of gases in class:**
   A) Crustacea
   B) Insecta
   C) Myriapoda
   D) Arachnida
2. **Larvae of which group are similar to chordates?**
   A) Echinodermata
   B) Annelida
   C) Arthropoda
   D) Nematoda
3. **Type of respiration which involves step by step breakdown of carbon chain molecules in the cell is called:**
   A) External respiration
   B) Cellular respiration
   C) Pulmonary respiration
   D) Cutaneous respiration
4. **Instrument which is used to measure relative abilities of different pigments to absorb different wavelengths of light is called:**
   A) Spectrometer
   B) Photometer
   C) Barometer
   D) Spectrophotometer
5. **End products of yeast fermentation, bacterial fermentation and anaerobic respiration are**
   A) Citric acid, lactic acid, carbon dioxide and water
   B) Ethyl alcohol, citric acid and carbon dioxide
   C) Ethyl alcohol, lactic acid, carbon dioxide and water
   D) Methanol, lactic acid and citric acid
6. **In human beings, what is the function of amylase in digestion?**
   A) Digestion of triglycerides
   B) Digestion of lipids
   C) Digestion of all types of food
   D) Digestion of carbohydrates
7. **Where is the ileocolic sphincter located in your body?**
   A) At the junction of esophagus and stomach
   B) At the junction of stomach and small intestine
   C) At the junction of ileum and large intestine
   D) At the junction of small intestine and large intestine
8. **The term which is employed to the loss of appetite due to fear of becoming obese is**
   A) Obesity
   B) Anorexia nervosa
   C) Dyspepsia
   D) Bulimia nervosa
9. **Which one of the following acts as functional unit of lungs in man?**
   A) Air sac
   B) Larynx
   C) Trachea
   D) Bronchioles
10. **Which one of following factors is directly proportional to oxygen carrying capacity of haemoglobin?**
    A) Carbon dioxide
    B) Temperature
    C) pH
    D) Light
11. **Expiration in human beings is carried out by**
    A) Contraction of lungs
    B) Contraction of intercostal membrane
    C) Relaxation of intercostal and diaphragm muscles
    D) Contraction of diaphragm muscles
12. **Which one of the following is a precursor of steroid hormones?**
    A) Glycerol
    B) Sterol
    C) Amino acids
    D) Cholesterol
13. **Granulocytes or white blood cells are produced in**
    A) Lymph nodes
    B) Red bone marrow
    C) Tonsils
    D) Spleen
14. **Which one of the following statements best describes the function of sinoatrial node?**
    A) It sends out electrical impulses to atrial muscles causing both atria to contract.
    B) It consists of small number of diffusely oriented cardiac fibres

C) It sends out electrical impulses to ventricular muscles causing both ventricles to contract
D) It is present at upper end of left atrium.

15. **The flow of lymph in lymphatic vessels is maintained by:**
A) Heart, activity of smooth muscles and valves
B) Activity of skeletal muscles, heart and breathing movements
C) Breathing movements, activity of skeletal muscles and valves
D) Exercise, breathing movements and heart

16. **Metabolic waste from metabolism of nucleic acid is**
A) Uric acid
B) Creatine
C) Urea
D) Creatinine

17. **The central metabolic station and clearing house of a body is**
A) Liver
B) Kidney
C) Nephron
D) Glomerulus

18. **The muscles that control urine in bladder are known as**
A) Striated muscles
B) Smooth muscles
C) Sphincter muscles
D) Circular muscles

19. **The living cells of cartilage are called**
A) Chrondrocytes
B) Osteoblasts
C) Osteocytes
D) Osteoclasts

20. **The disease which causes immobility and fusion of vertebral joints is**
A) Osteomalacia (soft bones)
B) Disc slip
C) Arthritis
D) Spondylosis

21. **During muscle contraction**
A) I-band shortens
B) Myosin filaments shorten
C) Actin filaments shorten
D) Z-line disappears

22. **Hormones are the organic compounds of varying structural complexity. Which of the following is not a function or property of these compounds?**
A) They initiate new biochemical reactions
B) They are poured directly into blood
C) They may be proteins
D) They affect target cells

23. **Reflexes and instincts type of behaviours respond to which combination /s?**
A) Biological rhythms, territorial, courtship and development
B) The responses that do produce same result in different conditions
C) Aggression, mating and altruism
D) The responses that are predetermined like differentiation.

24. **A typical neuron at rest**
A) Is more positive outside than inside
B) Is more negative outside than inside
C) Has no charge on either side
D) has an equal charge on either side

25. **The first cells produced by the repeated cell division of germinal epithelium of testis are**
A) Interstitial cells
B) Spermatogonia
C) Secondary spermatocytes
D) Spermatids

26. **Which of the following sequence is correct?**
A) LH FSH Estrogen Progesterone
B) FSH LH Progesterone Estrogen
C) FSH Estrogen Progesterone LH
D) FSH Estrogen LH Progesterone

27. **Which chromosomal abnormality in humans causes aggressive and antisocial behavior?**
A) XO
B) XXY
C) XYY
D) XXX

28. **Grey equatorial cytoplasm produces**
A) Muscle cells
B) Gut
C) Notochord and neural tube
D) Larval epidermis

29. **Sickle cell anaemia is an example of which type of chromosomal defect?**
A) Chromosomal rearrangement
B) Transposition of gene
C) Chromosomal aberration
D) Point mutation

30. **The karyotype of an individual is__of chromosomes.**

A) Number
B) Types
C) Number, types and chemical composition
D) Number and types

31. **The process of replication of DNA begins at**
A) One place only without any specific sequence of DNA
B) One or more places without any specific sequence of DNA
C) Any place with the uncoiling of two strands of DNA
D) One or more places where there is a specific sequence of nucleotides

32. **Amino acid attaches at which site of RNA**
A) Anticodon site
B) Ribosomes recognition site
C) 3'-site with terminal OH
D) Activation enzyme recognition site

33. **Microtubules of spindle fibres are composed of a protein called**
A) Tubulin
B) Actin
C) Myosin
D) Troponin

34. **The kinetochore fibres contract and spindle or pole fibres elongate during**
A) Prophase I
B) Metaphase I
C) Telophase I
D) Anaphase I

35. **Cell death due to tissue damage is called**
A) Necrosis
B) Metastasis
C) Apoptosis
D) Epistasis

36. **When a disease is transmitted directly from an affected father to his son, it is called:**
A) X-linked
B) Autosomal
C) Y-linked
D) X and Y-linked

37. **Epistasis is a relationship between:**
A) Alleles of a gene
B) Two different genes at the same locus
C) Two contrasting traits
D) Two different genes at different loci

38. **Gene for albinism in man is present on chromosome number:**
A) 11
B) 22
C) 21
D) 12

39. **Gene can be synthesized in laboratory from messenger RNA by using:**
A) Restriction enzymes
B) cDNA (complementary DNA)
C) Vector
D) Reverse transcriptase

40. **Antibiotic resistance gene for tetracycline and ampicillin are present in the plasmid**
A) pSC 101
B) pCR 101
C) pBR 322
D) pBR 233

41. **Cloning is a form of**
A) Sexual Reproduction
B) Asexual Reproduction
C) Vegetative Propagation
D) Genetic Recombination

42. **Group of interbreeding individuals of particular species, sharing common geographical area is called:**
A) Population
B) Community ecology
C) Community
D) Autecology

43. **Which of the following proteins is common in man and aerobic bacteria?**
A) Haemoglobin
B) Myoglobin
C) Cytochrome c
D) Pilin

44. **Ozone filters ultraviolet radiations from the sun in the upper**
A) Biosphere
B) Atmosphere
C) Lithosphere
D) Hydrosphere

45. **A parasite living inside body of the host is called**
A) Ectoparasite
B) Obligate parasite
C) Facultative parasite
D) Endoparasite

46. **An association between two organisms benefiting both is called**

A) Commensalism
B) Parasitism
C) Predation
D) Symbiosis

47. **In aquatic ecosystem, human activities may accelerate the process of**
A) Eutrophication
B) Photosynthesis
C) Decomposition
D) Recycling

48. **Beri Beri is due to**
A) Metabolic disorder
B) Chemical causes
C) Nutritional deficiency
D) Mental Illness

49. **The natural heat energy trapped underground is**
A) Geothermal energy
B) Thermal energy
C) Electric energy
D) Solar energy

50. **Which of the following is the lowest level of biological organization with respect to others?**
A) Multicellular organisms
B) Biosphere
C) Species
D) Population

51. **When an electron pair is shared between two atoms**
A) Two covalent bonds are formed
B) Hydrogen bond is formed
C) Single covalent bond is formed
D) Ionic bond is formed

52. **The first microbe to have the genome completely sequenced and was published on July 28th, 1995 was**
A) Hyphomicrobium
B) Haemophilus aquaticus
C) Haemophillus malariae
D) Haemophillus infulenzae

53. **An activated enzyme consisting of polypeptide and a cofactor is known as**
A) Amylase
B) Apoenzyme
C) Holoenzyme
D) Coenzyme

54. **_____ forms weak linkages with enzymes and their effect can be neutralized completely or partly by an increase in the concentration of the substrate.**
A) Only competitive Inhibitors
B) Reversible inhibitors
C) Irreversible inhibitors
D) Both reversible and irreversible inhibitors

55. **In prokaryotic cell, wall strengthening material is**
A) Cellulose
B) Silica
C) Chitin
D) Peptidoglycan

56. **The entire cell wall of bacteria is often regarded as a single huge molecule or molecular complex called**
A) Capsule
B) Secondary wall
C) Slime capsule
D) Sacculus

57. **Krebs's cycle takes place in**
A) Ribosomes
B) Golgi apparatus
C) Mitochondria
D) Endoplasmic Reticulum

58. **Chemically, viruses are made up of**
A) Nucleic acid only
B) Protein only
C) Nucleic acid and protein
D) Core and coat

59. **Widespread epidemic disease, influenza is caused by**
A) DNA virus
B) RNA enveloped virus
C) DNA enveloped virus
D) RNA virus

60. **When the division of cells is in three planes, the arrangement is known as**
A) Diplococcus
B) Sarcina
C) Streptococcus
D) Staphylococcus

61. **Bacterial 'death rate' is equal to 'birth rate; in**
A) Lag phase
B) Log phase
C) Death phase
D) Stationary phase

62. **Trypanosoma is a human parasite causing**

A) African sleeping sickness
B) European sleeping sickness
C) Indonesian sleeping sickness
D) American sleeping sickness

63. **The feeding stage of slime mold is a**
A) Gastrozoid
B) Sporozoite
C) Plasmodium
D) Merozote

64. **Drug obtained from fungus used for lowing blood cholesterol is**
A) Lovastatin
B) Cyclosporin
C) Ergotin
D) Griseofulvin

65. **Fungi store surplus food in the form of**
A) Cellulose
B) Glycogen
C) Starch
D) Both B and C

66. **The ecological role of fungi as decomposers is paralleled only by**
A) Prions
B) Algae
C) Bacteria
D) Viruses

67. **"Vascular System absent; gametophyte dominant, sporophyte attached to gametophyte; homosporous" are distinguishing characters of**
A) Psiolpsida
B) Pteropsida
C) Angiosperms
D) Bryophyta

68. **Which of the following features differentiate angiosperms from gymnosperms?**
A) Pollens disperse by air
B) Haploid microspores
C) Ovaries
D) Pollen tubes

69. **In Pakistan, the furniture wood is mainly obtained from the members of family:**
A) Rosaceae
B) Solanaceae
C) Minosaceae
D) Fabaceae

70. **Which of the following is exclusive character of mammals?**
A) Homeothermic
B) Hair
C) Poikliothermic
D) Four chambered heart

Answers :

1.	D	2.	A	3.	D	4.	B	5.	C	6.	D	7	C	8.	B	9.	A	10.	C
11	C	12	D	13	B	14	A	15	C	16	A	17	A	18	C	19	A	20	D
21	A	22	A	23	C	24	A	25	B	26	D	27	C	28	C	29	D	30	D
31	D	32	C	33	A	34	D	35	A	36	C	37	D	38	A	39	D	40	C
41	B	42	A	43	C	44	B	45	D	46	D	47	A	48	C	49	A	50	A
51	C	52	D	53	C	54	B	55	D	56	D	57	C	58	C	59	B	60	B
61	D	62	A	63	C	64	A	65	B	66	C	67	D	68	C	69	D	70	B

ENTRANCE TEST – 2011

BIOLOGY

1. **When chromosomes uncoil, the nucleoli are reformed and two nuclei are the two poles of the cell; stage is known as**
   A) Prophase
   B) Metaphase
   C) Telophase
   D) Anaphase
2. **Mental retardation, short stature, broad face and squint eyes are the symptoms of**
   A) Down's syndrome
   B) Klinefelter's syndrome
   C) Turner's syndrome
   D) XYZ syndrome
3. **Chiasmata formation takes place during the process which is known as**
   A) Crossing Over
   B) Attachment
   C) Pairing
   D) Leptotene
4. **Healing of a wound and repair is the phenomenon which takes place by the process of**
   A) Mitosis
   B) Meiosis
   C) Cell Growth
   D) Mitosis & Meiosis
5. **Which one of the following is the main cause of cancer?**
   A) Mutation
   B) Controlled Cell Division
   C) Regulated Mitosis
   D) Haploid Division
6. **The covalent bond formed between two monosaccharides is called**
   A) Glycosidic Bond
   B) Hydrogen Bond
   C) Peptide Bond
   D) Disulphide
7. **The bond formed between glucose and fructose form sucrose is**
   A) 1,4 Glycosidic Linkage
   B) 1,2 Glycosidic Linkage
   C) 1,6 Glycosidic Linkage
   D) 1,3 Glycosidic Linkage
8. **In an amino acid in which the R-group is H, its name will be**
   A) Alanine
   B) Glycine
   C) Leucine
   D) Valine
9. **Fatty acid are the organic compounds containing hydrogen, oxygen and one of the following are**
   A) –COOH
   B) $-NH_2$
   C) Acyl
   D) Sucrose
10. **Liposomes are used in gene therapy against**
    A) Hypercholesterolemia
    B) Coronary Artery Angioplasty s
    C) Cystic Fibrosis
    D) Severe Combined Immunodeficiency Syndrome (SCID)
11. **Genetically engineered cells are introduced into bone marrow cells in the treatment of**
    A) Hypercholesterolemia
    B) Severe Combined Immunodeficiency Syndrome
    C) Cystic Fibrosis
    D) Coronary Artery Angioplasty (SCID)
12. **Which one of the following is depleting and causing thinning of ozone?**
    A) Chlorine
    B) Bromine
    C) Chlorofluorocarbon
    D) Carbon
13. **The typical environment of a particular organism population community is called**
    A) Niche
    B) Ecosystem
    C) Habitat
    D) Biosphere
14. **Excessive enrichment of water with nutrients by human activity by which large amount of living organic matter grows is called**
    A) Archeotrophication
    B) Eutrophication
    C) Enrichment
    D) Low Trophication
15. **In an ecosystem, mycorrhizae is an example of**

A) Symbiosis
B) Predation
C) Commensalism
D) Parasitism

16. **Successive stages of eating and being eaten by which recycling of materials and flow of energy takes place is called**
A) Food Chain
B) Food Web
C) Trophic Level
D) Food Link

17. **The sex of individuals of next generation always depends on one of the parents who is**
A) Heterogametic
B) Homogametic
C) Isogametic
D) Isomorphic

18. **Which of the following will be hemophilic?**
A) X^HX^h
B) X^HX^H
C) X^hY
D) X^HY

19. **Which of the following is an example of X-linked recessive trait in humans?**
A) Hypophospatemic Rickets
B) Colour Blindness
C) Baldness
D) Beard Growth

20. **Which trait in human in an example of multiple alleles?**
A) Eye Colour
B) Skin Colour
C) ABO-Blood Group
D) Rh-Blood Group

21. **When a gene pair at one locus interacts with another gene at another locus, the interaction is called**
A) Dominance
B) Multiple Alleles
C) Pleiotropy
D) Epistasis

22. **The combination of a pentose sugar with a base result in a compound is known as**
A) Nucleotide
B) Nucleoside
C) Nucleic Acid
D) Polynucleotide

23. **An enzyme and substrate reacts through a special feature or site present in enzyme:**
A) Building Site
B) Active Site
C) Catalyst Site
D) Inhibition Site

24. **The non-protein part of enzyme which is covalently and permanently bonded is called**
A) Prosthetic Group
B) Co-Factor
C) Co-Enzyme
D) Activator

25. **One of the pyrimidine bases is absent in DNA**
A) Uracil
B) Thymine
C) Cytosine
D) Adenine

26. **Enzymes increase the rate of reaction by**
A) Increasing Temperature
B) Decreasing pH
C) Decreasing Activation Energy
D) Increasing Activation Energy

27. **Which one of the following diseases caused by enveloped RNA virus and spread in epidemic form?**
A) Influenza
B) Herpes Simplex
C) Polio
D) Small Pox

28. **The structure which contains the gene for drug resistance bacteria are**
A) Nucleoids
B) Mesosomes
C) Chromatin Bodies
D) Plasmids

29. **Antibiotics that kill microbes immediately are called**
A) Microbistatic
B) Microbicidal
C) Biostatic
D) Chemotherapeutic

30. **Which one of the following fungi causes vaginal thrush?**
A) Candida
B) Aspergillus
C) Tortula
D) Penicillium

31. **Body cavity of round worms is called**
A) Pseudocoelom
C) Acoelom

B) Coelom
D) Enteron

32. **Fasciola is endoparasite of**
A) Colon
B) Liver
C) Small Intestine
D) Bile Duct

33. **Trypanosoma is transmitted in human beings by**
A) Plasmodium
B) Anopheles
C) House Fly
D) Tsetse Fly

34. **The nervous system develops from which of the following layer during embryonic development of animals**
A) Mesoderm
B) Ectoderm
C) Endoderm
D) Mesoderm and Endoderm

35. **Endosperm is formed as a result of**
A) Pollination
B) Self-Pollination
C) Double Fertilization
D) Cross Pollination

36. **Which of the following enzyme is released in an inactive form**
A) Amylase
B) Lipase
C) Enterokinase
D) Pepsin

37. **Which of the following hormones stimulate the secretion of pancreatic juice from pancreas in liver?**
A) Secretin
B) Pepsinogen
C) Gastrin
D) Both Gastrin and Secretin

38. **In large intestine, vitamin k is formed by the activity of**
A) Symbiotic Bacteria
B) Obligate Bacteria
C) Parasitic Bacteria
D) Facultative Bacteria

39. **During swallowing of food which structure close nasal opening?**
A) Hard Palate
B) Soft Palate
C) Epiglottis
D) Larynx

40. **The right atrium of the heart usually receives the**
A) Deoxygenated Blood
B) Oxygenated Blood
C) Filtered Blood
D) Non-Filtered Blood

41. **The largest lymph duct called thoracic lymph duct drains into**
A) Subclavian Vein
B) Renal Vein
C) Pulmonary Vein
D) Hepatic Portal Vein

42. **Which protein plays a major role in maintaining osmotic balance?**
A) Albumin
B) Globulin
C) Fibrinogen
D) Prothrombin

43. **The type of agranulocytes which stays in blood for a few hours and then enters tissues and become macrophages are**
A) Lymphocytes
B) Monocyte
C) Eosinophils
D) Basophils

44. **Reabsorption of water by counter current multiplier mechanism takes place at**
A) Proximal Tubule
B) Distal Tubule
C) Collecting Duct
D) Loop of Henle

45. **Antiduretic hormone helps in reabsorption of water by changing permeability of**
A) Proximal Tubule
B) Distal Tubule
C) Collecting Duct
D) Loop of Henle

46. **During peritoneal dialysis, dialysis fluid is introduced into which part of human body?**
A) Liver
B) Abdomen
C) Kidney
D) Pancreas

47. **Aldosterone helps in conservation or active absorption of**
A) Sodium
B) Calcium
C) Potassium
D) Bicarbonate Ions

48. **Maximum reabsorption takes place in which part of the nephron?**

A) Distal Tubule
B) Villi
C) Cortical Tissue
D) Proximal Tubule

49. **Over-activity of sympathetic nervous system causes**
A) Disturbance of Vision
B) Constipation
C) Decrease in Blood Pressure
D) Increase in Heart Rate

50. **Which structures respond when they are stimulated by impulse coming through motor neuron?**
A) Receptors
B) Responses
C) Effectors
D) Transduction

51. **Respiratory center is located in**
A) Cerebrum
B) Cerebellum
C) Medulla
D) Hypothalamus

52. **A neurological condition characterized by involuntary tremors, diminished motor activity and rigidity is called**
A) Epilepsy
B) Parkinson's Disease
C) Alzheimer's Disease
D) Cerebullar Tumours

53. **A type of cell in human testes which produces testosterone is called**
A) Interstitial Cells
B) Germ Cells
C) Sertoli Cells
D) Spermatocytes

54. **Breakdown of endometrium during menstruation is due to**
A) Increase in Level of LH
B) Decrease in Level of Progesterone
C) Increase in Level of Progesterone
D) Increase in Level of Oestrogen

55. **Oogonia are produced in the germ cells**
A) Both Uterus and Cervix
B) Cervix
C) Uterus
D) Ovary

56. **Which of the following diseases can be prevented through vaccination?**
A) AIDS and Cancer
B) Malaria and AIDS
C) Typhoid and Cancer
D) Measles and Mumps

57. **Newly produced cells/individuals which are identical in each other are known as**
A) Genetically Modified
B) Transgenic Animals
C) Transgenic Bacteria
D) Clones

58. **Which of the following is a blood borne disease?**
A) Hepatitis
B) Cholera
C) Influenza
D) Candidiasis

59. **The control of pest has traditionally meant regulation by natural enemies, predators, parasites and pathogens. This type of control is known as**
A) Cultural Control
B) Biological Control
C) Pesticides Control
D) Insecticides Control

60. **Which of the following organelles is concerned with the cell secretion**
A) Ribosomes
B) Golgi Apparatus
C) Lysosomes
D) Mitochondria

61. **Which of the following contains peptidoglycan cell wall?**
A) Penicillium
B) Bacterium
C) Adiantum
D) Polytrichum

62. **The inner membrane of mitochondria is folded to form finger like structure called**
A) Cristae
B) Vesicle
C) Matrix
D) Cisternae

63. **Interior of chloroplast is divided into heterogeneous structure, embedded in the matrix known as**
A) Grana
B) Stroma
C) Thylakoids
D) Cisternae

64. **In which phase of the cell division the metabolic activity of the nucleus is high?**
A) Mitosis
C) Meiosis

B) Interphase
D) Cell Cycle

65. **Luteinizing hormone triggers**
A) Cessation of Oogenesis
B) Breakdown of Oocyte
C) Ovulation
D) Development of Zygote

66. **Syphilis is a sexually transmitted disease which is caused by**
A) HIV / AIDS
B) Pseudomonas
C) Treponema Pallidum
D) Neisseria

67. **Muscle is made up of many cells which are referred to as**
A) Myofilaments
B) Myofibrils
C) Sarcolemma
D) Muscles Fiber

68. **The length of myofibril from one Z-band to the next is known as**
A) Sarcomere
B) Sarcolemma
C) Sarcoplasm
D) Muscle Fiber

69. **Calcium ions released during a muscle fiber contraction attach with**
A) Myosin
B) Actin
C) Tropomyosin
D) Troponin

70. **A muscle condition resulting from the accumulation of lactic acid and ionic imbalance is:**
A) Tetany
B) Muscle Fatigue
C) Cramp
D) Tetanus

71. **The pigment which stores oxygen in muscles is**
A) Hemoglobin
B) Myoglobin
C) Myosin
D) Actinomyosin

72. **Neurosecretory cells are present in which part of brain**
A) Hypothalamus
B) Midbrain
C) Pons
D) Cerebellum

73. **Which of the following is the function of glucagon hormone?**
A) Glycogen to Glucose
B) Glucose to Glycogen
C) Glucose to Lipids
D) Glucose to Proteins

74. **Addison's disease is caused due to destruction of**
A) Adrenal Cortex
B) Pituitary Adrenal Axis
C) Adrenal Medulla
D) Hypothalamus

75. **Which group of hormones is made up of amino acids and their derivatives?**
A) Vasopressin and ADH
B) Epinephrine and Non-Epinephrine
C) Osterogen and Testosterone
D) Insulin and Glucagon

76. **Thymus gland is involved in maturation of**
A) Platelets
B) B-Lymphocytes
C) Eosinophils
D) T-Lymphocytes

77. **In passive immunity which of the following component are injected into blood**
A) Antigens
B) Immunogens
C) Serum
D) Immunoglobulins

78. **Mucous membranes are part of body defense system and they offer**
A) Physical Barriers
B) Mechanical Barriers
C) Chemical Barriers
D) Biological Barriers

79. **Immediate protection is obtained from**
A) Passive Immunity
B) Active Immunity
C) Vaccination
D) Natural Activity Immunity

80. **The immunity in which T-cells recognize the antigens or micro-organisms is known as**
A) Tissue Grafting
B) Phagocytosis
C) Cell Mediated Immunity / Response
D) Hormonal Immunity / Response

81. **Oxidative phosphorylation, synthesis of ATP in the presence of oxygen occurs in:**
A) All Types of Cells
B) All Anaerobic Cells
C) All Primitive Cells
D) All Aerobic Cells

82. **Glycolysis is the breakdown of glucose into two molecules of**
A) Glycerate
B) Lactic Acid
C) Pyruvate
D) Succinic Acid

83. **Before entering Krebs's cycle, the pyruvate is first decarboxylated and oxidized into**
A) Alpha Ketoglutaric Acid
B) Citric Acid
C) Glyceric Acid
D) Acetic Acid

84. **Some electron from the second primary acceptor may pass back to chlorophyll molecules by electron carrier system, yielding ATP. This process is called**
A) Phosphorylation
B) Photophosphorylation
C) Non-Cyclic Phosphorylation
D) Cyclic Phosphorylation

85. **Z-scheme is used for**
A) Non-Cyclic Photophosphorylation
B) Cyclic Photophosphorylation
C) Both Cyclic and Non-Cyclic Photophosphorylation
D) Oxidative Phosphorylation

86. **The common vectors used in recombinant DNA technology are**
A) Probes
B) Palindromes
C) Plasmids
D) Prions

87. **The enzyme used to isolate gene from DNA is**
A) Helicase
B) Reverse Transcriptase
C) Restriction Enzyme
D) DNA Polymerase

88. **Which one of the following enzymes is temperature insensitive?**
A) DNA Polymerase I
B) Taq Polymerase
C) DNA Polymerase III
D) RNA Polymerase

Answers :

1.	C	2.	A	3.	A	4.	A	5.	A	6.	A	7	B	8.	B	9.	A	10.	C
11	B	12	C	13	C	14	B	15	A	16	A	17	A	18	C	19	B	20	C
21	D	22	B	23	B	24	A	25	A	26	C	27	A	28	D	29	B	30	A
31	A	32	D	33	D	34	B	35	C	36	D	37	A	38	A	39	B	40	A
41	A	42	A	43	B	44	D	45	B	46	C	47	A	48	D	49	D	50	C
51	C	52	B	53	A	54	B	55	D	56	D	57	A	58	A	59	B	60	B
61	B	62	A	63	A	64	B	65	C	66	C	67	D	68	A	69	D	70	B
71	B	72	A	73	A	74	A	75	B	76	D	77	D	78	A	79	A	80	C
81	C	82	C	83	D	84	D	85	A	86	C	87	C	88	B				

ENTRANCE TEST – 2012

BIOLOGY

1. **The part of neuron fibre which conducts nerve impulses from the cell body is**
   A) Dendron
   B) Dendrites
   C) Axon
   D) Peripheral branch
2. **The number of cranial nerves in human is**
   A) 31 pairs
   B) 12 pairs
   C) 24 pairs
   D) 62 pairs
3. **The part of brain which controls breathing, heart rate and swallowing is**
   A) Cerebrum
   B) Cerebellum
   C) Medulla
   D) Hypothalamus
4. **Syphilis is a sexually transmitted disease which is caused by**
   A) Neisseria gonorrhoeae
   B) E. coli
   C) Treponema pallidum
   D) Mycobacterium avium
5. **Discharge of ovum or secondary oocyte from ovary or from Graafian follicle is called**
   A) Fertilization
   B) Pollination
   C) Follicle formation
   D) Ovulation
6. **Second meiotic division in the secondary oocyte proceeds as far as**
   A) Metaphase
   B) Prophase
   C) Anaphase
   D) Telophase
7. **Which one of the following differentiates directly into mature sperm?**
   A) Primary spermatocyte
   B) Secondary spermatocyte
   C) Spermatogonia
   D) Spermatid
8. **Uterus opens into the vagina through**
   A) Cervix
   B) Fallopian tube
   C) External genitalia
   D) Vulva
9. **Each muscle fibre is surrounded by membrane which is called**
   A) Sarcomere
   B) Sarcolemma
   C) Twitch fibre
   D) Capsule
10. **When calcium ions are released from the sarcoplasmic reticulum they bind with _____ during muscle contraction**
    A) Tropomyosin
    B) Sarcolemma
    C) Cytosol's ions
    D) Troponin
11. **Human and mammalian skeleton can be divided into two parts, axial skeleton and**
    A) Appendicular skeleton
    B) Exoskeleton
    C) Endoskeleton
    D) Hydrostatic skeleton
12. **Last four vertebrae in humans are fused to form a structure called**
    A) Sacrum
    B) Cervical vertebrae
    C) Pubis
    D) Coccyx
13. **How many bones are involved in the formation of each half of pelvic girdle?**
    A) 3 bones
    B) 4 bones
    C) 2 bones
    D) 1 bone
14. **Ductless glands are known as**
    A) Endocrine gland
    B) Exocrine gland
    C) Salivary glands
    D) Bile glands
15. **Gastrin is the hormone which is produced by the**
    A) Liver
    B) Pyloric region of stomach
    C) Adrenal gland
    D) Mucosal lining of intestine
16. **β-cells of liver secrete a hormone that is called**
    A) Insulin
    C) Antidiuretic hormone

B) Glucagon
D) Gastrin

17. **Vasopressin and Oxytocin are released from the**
A) Placenta
B) Ovary
C) Anterior pituitary
D) Posterior pituitary

18. **Antigen is a foreign protein or any other molecule which stimulates the formation of**
A) MHC complex
B) Immunogen
C) Mucus
D) Antibodies

19. **Antibodies are produced by which of the following lymphocytes?**
A lymphocytes
B lymphocytes
C) T lymphocytes
D) B and T lymphocytes

20. **T-lymphocytes become mature and competent under the influence of**
A) Liver
B) Bursa of fabricius
C) Thymus gland
D) Spleen

21. **Skin and mucous membranes are part of the body defense system and they form the**
A) Physical barrier
B) Mechanical barriers
C) Chemical barriers
D) Biological barriers

22. **Snake bite is treated with which type of immunization?**
A) Active
B) Passive
C) Humoral
D) Specific

23. **The product(s) of cyclic photophosphorylation is / are:**
A) ATP
B) NADP
C) NADP and ATP
D) NADP, ATP, and O2

24. **Total NADH formed by one glucose molecule during Krebs's Cycle are**
A) 6
B) 3
C) 8
D) 18

25. **The terminal electron acceptor in electron transport chain is**
A) Hydrogen
B) Iron
C) Cytochrome
D) Oxygen

26. **The end product of glycolysis is**
A) ADP
B) Reduced FAD
C) Citric acid
D) Pyruvate

27. **One molecule of FADH2 is produced in Krebs's cycle during conversion of**
A) Fumarate Malate
B) Succinate Fumarate
C) Malate Oxaloacetate
D) α-Ketoglutarate Succinate

28. **In recombinant DNA technology__are tools for manipulating DNA**
A) Viruses
B) Chromosomes
C) Enzymes
D) Genes

29. **In DNA finger printing process, the use of__produces distinctive pattern on autoradiography or X-ray film**
A) Restriction enzyme
B) Microsatellites
C) Macrosatellites
D) Probes for genetic markers

30. **In the recombinant DNA technology plasmids are used as**
A) Genetic material
B) Enzymes
C) Vectors
D) Probes

31. **In which process, multiple copies of the desired genes are produced?**
A) Polymerase chain reaction
B) Gene sequencing
C) Analyzing DNA
D) DNA finger printing

32. **The enzyme adenosine deaminase is missing in person suffering from:**
A) Cystic fibrosis
B) Hypercholesterolemia
C) Severe combined immunodeficiency syndrome
D) Parkinson's disease

33. **What is the niche of an organism in an ecosystem?**
A) Role played by many organisms in an ecosystem

B) Role played by a dead organism in an ecosystem
C) Role played by community of microorganisms in their ecosystem
D) Role played by an organism in its ecosystem.

34. **The distinct levels or links of food chain are called**
A) Trophic level
B) Food web
C) Energy pyramid
D) Food chain

35. **A relationship between two or more organisms of different species in which all partners get benefit is called**
A) Symbiosis
B) Parasitism
C) Commensalism
D) Predation

36. **Bacteria and fungi are examples of**
A) Producers
B) Decomposers
C) Consumers
D) ALL of these

37. **The cause of acid rain is**
A) Oxides of carbon
B) Oxides of nitrogen and Sulphur
C) Oxides of Sulphur
D) Oxides of nitrogen

38. **When the presence of a gene at one locus suppresses the effect of a gene at another locus, the phenomenon is called**
A) Hypostasis
B) Pleiotropy
C) Epistasis
D) Epitropy

39. **The gene for ABO-blood group systems in humans is represented by symbol:**
A) X
B) I
C) Y
D) O

40. **When a single gene affects two or more traits, the phenomenon is called**
A) Epistasis
B) Pleiotropy
C) Dominance
D) Over dominance

41. **The comparative embryology of all vertebrates shows development of**
A) Hairs
B) Gill pouches
C) Scales
D) Fins

42. **In men, sex-determination depends upon the nature of**
A) Heterogametic male
B) Homogametic female
C) Heterogametic female
D) Homogametic male

43. **Population of different species (plants and animals) living in the same habitat form a**
A) Community
B) Ecosystem
C) Biosphere
D) Microhabitat

44. **The part of the body which forms a structural and functional unit and is composed of more than one tissue is called**
A) Organ
B) Organelle
C) Organ system
D) Whole organism

45. **A method in which pests are destroyed by using same living organisms or natural enemies is called**
A) Pasteurization
B) Integrated disease management
C) Biological control
D) Genetic engineering

46. **Chemicals produced by microorganisms which are capable of destroying the growth of microbes are called**
A) Antigen
B) Biocidal
C) Antiseptics
D) Antibiotics

47. **Plastids are only found in the**
A) Animals and Plants
B) Animals
C) Plants
D) Viruses

48. **Plasma membrane is chemically composed of**
A) Phospholipids only
B) Lipids and proteins
C) Lipids and carbohydrates
D) Glycoproteins

49. **Endoplasmic reticulum contains a system of flattened membrane-bounded sacs which are named as**
A) Cristae
B) Marks
C) Cisternae
D) Tubules

50. **Lipids synthesis / metabolism takes place in which of the following organelle?**
A) Mitochondria
B) Vacuoles
C) Rough endoplasmic reticulum
D) Smooth endoplasmic reticulum

51. **Ribosomes exist in two forms, either attached with RER or freely dispersed in the**
A) Tonoplast
B) Golgi bodies
C) Cytoplasm
D) SER

52. **Exchange of segments between homologous chromosomes is called**
A) Segregation
B) Independent assortment
C) Crossing over
D) Mutation

53. **If a person has 44 autosomes + XXY, he will suffer from**
A) Klinefelter's syndrome
B) Down's syndrome
C) Turner's syndrome
D) Edward's syndrome

54. **The ribosomal RNA is synthesized and stored in**
A) Endoplasmic reticulum
B) Nucleolus
C) Golgi complex
D) Chromosomes

55. **In which stage of Interphase, there is increase in cell size and many biochemical are formed?**
A) G2 phase
B) G1 phase
C) S phase
D) C phase

56. **In Down's syndrome, which one of the following pair of chromosome fails to segregate?**
A) 7
B) 18
C) 21
D) 19

57. **Carbohydrates are organic molecules and contain three elements**
A) Carbon, water and oxygen
B) Carbon, Sulphur and hydrogen
C) Carbon, calcium and hydrogen
D) Carbon, hydrogen and oxygen

58. **Which one are intermediates in respiration and photosynthesis both?**
A) Ribose and heptolose
B) Glyceraldehydes and dihydroxyacetone
C) Glucose and galactose
D) Fructose and ribulose

59. **Which of the following is a peptide bond?**
A) –C–N
B) –C–O
C) –C–P
D) –C–S

60. **Which of the following is an unsaturated fatty acid?**
A) Acetic Acid
B) Butyric acid
C) Oleic acid
D) Palmitic acid

61. **Which of the following combination of base pair is absent in DNA?**
A) A–T
B) C–G
C) A–U
D) T–A

62. **The type of inhibition in which inhibitor has no structural similarity to substrate and combines with enzyme at other than the active site is called**
A) Irreversible inhibition
B) Competitive inhibition
C) Non-competitive and reversible inhibition
D) Reversible inhibition

63. **The inhibitors that bind tightly and permanently to enzymes and destroy their globular structure and catalytic activity are**
A) Reversible inhibitors
B) Irreversible inhibitors
C) Competitive inhibitors
D) Non-competitive inhibitors

64. **Enzyme succinate dehydrogenase converts succinate into**
A) Malate
B) Malonic acid
C) Citrate
D) Fumarate

65. **If the detachable co-factor is an inorganic ion then it is designated as**
A) Coenzyme
C) Holoenzyme

B) Prosthetic group
D) Activator

66. **In HIV viruses, reverse transcriptase converts single-stranded RNA into double stranded viral DNA. This process is called**
A) Translation
B) Duplication
C) Replication
D) Reverse Transcriptase

67. **Mesosomes are infoldings of the cell membrane and are involved in**
A) DNA replication
B) RNA synthesis
C) Protein synthesis
D) Metabolism

68. **Most widespread problem of the antibiotics misuse is the**
A) Rapid cure
B) Increased resistance in pathogen
C) Disturbance of metabolism
D) Immunity

69. **Which of the following component is found in the cell wall of fungi?**
A) Cellulose
B) Chitin
C) Proteins
D) Glycerol

70. **The male reproductive parts of the flower are called**
A) Gynoecium
B) Calyx
C) Androecium
D) Corolla

71. **Fasciola is the name given to**
A) Tapeworm
B) Planaria
C) Liver fluke
D) Earthworm

72. **Ascaris is**
A) Diploblastic
B) Triploblastic
C) Haploid
D) Acoelomate

73. **During development, in an animal, mesoderm layer gives rise to**
A) Nervous System
B) Alimentary canal lining
C) Muscular and skeletal system
D) Mouth

74. **Polymorphism is characteristic feature of**
A) Porifera
B) Cnidaria
C) Annelida
D) Nematodes

75. **The muscles of the stomach walls thoroughly mix up the food with gastric juices and the resulting semi-solid / semi-liquid material is called**
A) Bolus
B) Bolus or chime
C) Mucus
D) Chyme

76. **Trypsinogen is converted into trypsin by the activity of**
A) Goblet cells
B) Absorptive cells
C) Enterokinase
D) Peptidase

77. **In large intestines, vitamin K is formed by the activity of**
A) Symbiotic bacteria
B) Obligate parasite
C) Parasitic bacteria
D) Facultative bacteria

78. **Goblet cells secrete**
A) HCl
B) Mucus
C) Enzymes
D) Amylase

79. **Mature mammalian red blood cells do not have**
A) Nucleus
B) Red color
C) Fluids
D) Haemoglobin

80. **In a normal person plasma constitutes about____by volume of blood**
A) 50%
B) 60%
C) 45%
D) 55%

81. **Which vein has oxygenated blood?**
A) Renal vein
B) Subclavian vein
C) Pulmonary vein
D) Jugular vein

82. **What is the residual volume of air which always remains inside the lungs of human?**
A) 3.5 Liters
C) 5.0 Liters

B) 0.5 Liters
D) 1.5 Liters

83. **In nephron, most of the reabsorption takes place in the**
A) Distal tubule
B) Proximal tubule
C) Ascending limb
D) Descending limb

84. **Detection of change and signaling for effector's response to the control system is a**
A) Negative feedback
B) Positive feedback
C) Inter-coordination
D) Feedback mechanism

85. **What are three components of mechanism of homeostatic regulations?**
A) Receptors, control centre and effectors
B) Sensory, motor and associative neurons
C) CNS, PNS and diffused nervous system
D) Cerebrum, cerebellum and pons

86. **Blood enters the glomerulus through**
A) Efferent arteriole
B) Afferent arteriole
C) Renal artery
D) Renal vein

87. **Which portion of nephron is under the control of ADH?**
A) Bowman's capsule
B) Ascending arm
C) Distal and collecting ducts
D) Descending arm

88. **Cause of Parkinson's disease is death of brain cells that produce**
A) Dopamine
B) Acetylcholine
C) ADH hormone
D) Oxytocin

Answers :

1.	C	2.	B	3.	C	4.	C	5.	D	6.	A	7	D	8.	A	9.	B	10.	D
11	A	12	D	13	A	14	A	15	C	16		17	D	18	D	19	A	20	C
21	A	22	B	23	A	24	A	25	D	26	D	27	B	28	C	29	D	30	C
31	A	32	C	33	D	34	A	35	A	36	B	37	B	38	C	39	B	40	B
41	B	42	A	43	A	44	A	45	C	46	D	47	C	48	B	49	C	50	D
51	C	52	C	53	A	54	B	55	B	56	C	57	D	58	B	59	A	60	C
61	C	62	C	63	B	64	D	65	D	66	D	67	A	68	B	69	B	70	C
71	C	72	B	73	C	74	B	75	D	76	C	77	A	78	B	79	A	80	D
81	C	82	D	83	B	84	D	85	A	86	B	87	C	88	A				

ENTRANCE TEST – 2013

BIOLOGY

1. **The simplest independent unit of life is known as:**
   A) Bacterial colony
   B) Cell
   C) Chloroplast
   D) DNA
2. **The process by which unwanted structures within the cell are engulfed and digested within the lysosome is known as:**
   A) Endocytosis
   B) Exocytosis
   C) Hydrolysis
   D) Autophagy
3. **The plants having foreign DNA incorporated into their cells are called:**
   A) Clonal plants
   B) Transgenic plants
   C) Biotech plants
   D) Tissue cultured plants
4. **Pasteurization technique is widely used for preservation of:**
   A) Water
   B) Heat
   C) Milk products
   D) Vaccines
5. **The production of genetically identical copies of organisms by asexual reproduction is called:**
   A) Genetic engineering
   B) Integrated disease management
   C) Hydroponic culture technique
   D) Cloning
6. **The___model of plasma membrane suggests that proteins are embedded in lipid bilayer:**
   A) Unit membrane
   B) Fluid mosaic
   C) Permeable
   D) Ultracentrifuge
7. **The function of nucleolus is to make:**
   A) rDNA
   B) Ribosomes
   C) RNA
   D) Chromosomes
8. **Lipid metabolism is the function of:**
   A) Mitochondria
   B) Sarcoplasmic reticulum
   C) RER
   D) SER
9. **The enzymes of lysosomes are synthesized on:**
   A) RER
   B) SER
   C) Chloroplast
   D) Golgi Apparatus
10. **Centrioles are made up of___microtubules:**
    A) 9
    B) 27
    C) 3
    D) 12
11. **Which of the following structures is absent in higher plants and found in animal cells:**
    A) Centriole
    B) Cytoskeleton
    C) Mitochondria
    D) Cytoplasm
12. **The soluble part of cytoplasm or fluid that remains when all organelles are removed is known as:**
    A) Solution
    B) Gelatin material
    C) Cytoskeleton
    D) Cytosol
13. **The outer membrane of the nuclear envelope is at places continuous with the:**
    A) Golgi apparatus
    B) Endoplasmic Reticulum
    C) Lysozymes
    D) Peroxisomes
14. **Down's syndrome is a result of non-disjunction of_____ pair of chromosomes that fails to segregate:**
    A) 21st
    B) 22nd
    C) 18th
    D) 24th
15. **_____ is most abundant carbohydrate in nature.**
    A) Waxes
    B) Glycerol
    C) Starch
    D) Cellulose
16. **Which of the following is a keto sugar:**

A) Glyceraldehyde
B) Dihydroxy-acetone
C) Ribose
D) Glucose

17. **Amino acid in which the R-group is hydrogen is:**
A) Glycine
B) Alanine
C) Leucine
D) Valine

18. **Acyl-glycerols like fats and oils are esters formed by condensation reaction between:**
A) Fatty acids and water
B) Fatty acids and alcohols
C) Fatty acids and glucose
D) Fatty acids and phosphates

19. **Which of the following is purine:**
A) Guanine
B) Cytosine
C) Thymine
D) Uracil

20. **If the co-factor is covalently or tightly and permanently bonded to enzyme then it will be called:**
A) Coenzyme
B) Prosthetic group
C) Activator
D) Apoenzyme

21. **Optimum pH value for the working of pancreatic lipase is:**
A) 4.50
B) 7.60
C) 2.00
D) 9.00

22. **The view that active site of an enzyme is flexible and when a substrate combines with it, cause changes in enzyme structure is known as:**
A) Lock & key model
B) Induce fit model
C) Sliding filament model
D) Specificity model

23. **All coenzymes are derived from:**
A) Proteins
B) Nucleic acids
C) Carbohydrate
D) Vitamins

24. **Reverse transcription is used to make DNA copies of:**
A) Host RNA
B) Viral RNA
C) Host DNA
D) Viral DNA

25. **Antibiotics are produced by fungi and certain bacteria of group:**
A) Actinomycetes
B) Oomycetes
C) Ascomycetes
D) Basidiomycetes

26. **Which statement about bacteria is true:**
A) Gram positive bacteria have more lipids in their cell wall
B) Gram negative bacteria have more lipids in their cell wall
C) Lipids are absent in cell wall of both gram positive and negative bacteria
D) Both have equal amount of lipids

27. **Fungi which cause thrush in humans:**
A) Sarcomeres
B) Candidiasis
C) Lovastatin
D) Aspergillus

28. **When beef which is not properly cooked is consumed by humans, they become infected by:**
A) Tape worm
B) Hook worm
C) Pin worm
D) Round worm

29. **Sleeping sickness in humans is caused by:**
A) Trypanosoma
B) Plasmodium
C) Anopheles
D) Stentor

30. **Schistosoma is a parasite that lives in the__of the host.**
A) Intestine
B) Kidney
C) Liver
D) Blood

31. **The cavity between body wall and alimentary canal is:**
A) Coelom
B) Mesoderm
C) Endoderm
D) Mesoglea

32. **The layer which forms the lining of digestive tract and glands of digestive system is:**
A) Ectoderm
B) Mesoderm
C) Endoderm
D) Mesoglea

33. **Which one of the following vitamins is produced by microflora of large intestine?**
A) Vitamin K
B) Vitamin C
C) Vitamin A
D) Vitamin D

34. **_____ is activated to_____by Enterokinase / enteropeptidase enzyme secreted by the lining of duodenum:**
A) Pepsinogen, Pepsin
B) Pepsinogen, Trypsin
C) Trypsinogen, Trypsin
D) Chymotrypsinogen, Chymotrypsin

35. **Which of the following are absorbed in the large intestine?**
A) Water and salts
B) Water and peptones
C) Salts and glycerol
D) Amino acids and sugars

36. **Saliva is basically composed of water, mucus, amylase and:**
A) Sodium bicarbonate
B) Sodium chloride
C) Sodium hydroxide
D) Hydrocarbons

37. **The total inside capacity of lungs is__ for man.**
A) 6.7 liters
B) 2.5 liters
C) 7 liters
D) 5 liters

38. **The average life span of red blood cell is about:**
A) Four months
B) Two months
C) Five months
D) One month

39. **The lymphatic vessels of the body empty the lymph into blood stream at the:**
A) Abdominal vein
B) Subclavian vein
C) Jugular vein
D) Bile duct

40. **Right atrium is separated from right ventricle by:**
A) ricuspid valve
B) Bicuspid valve
C) Semilunar valve
D) Septum

41. **Site of filtration in nephron is:**
A) Glomerulus and Bowman's capsule
B) Proximal and Distal end
C) Ascending and descending arm
D) Loop of Henle

42. **Antidiuretic hormone increases the reabsorption of:**
A) Amino acids
B) Salts
C) Ammonia
D) Water

43. **Active uptake of_____in the ascending limb or thick loop of Henle is promoted by the action of aldosterone:**
A) K^+
B) Cl^-
C) Ca^{++}
D) Na^+

44. **The process through which the body maintains the internal environment from the fluctuations of external environment is called as:**
A) Behavior of organisms
B) Adaptation
C) Thermoregulation
D) Homeostasis

45. **Active pumping out of Na^+ occurs at which part of nephron:**
A) Proximal tubule
B) Descending loop of Henle
C) Ascending loop of Henle
D) Collecting ducts

46. **The structures which respond when they are stimulated by impulse coming through motor neuron are:**
A) Receptors
B) Responders
C) Transducers
D) Effectors

47. **Thalamus and cerebrum are the part of:**
A) Fore brain
B) Mid brain
C) Hind brain
D) Spinal cord

48. **There is also EVIDENCE that high levels of_may contribute to the onset of Alzheimer's disease:**

A) Mg
B) Mo
C) Al
D) Ca

49. **L-dopa or Levodopa is used to get some relief from??**
A) Epilepsy
B) Alzheimer's disease
C) Parkinson's disease
D) Dementia

50. **Spermatogonia differentiate directly into?**
A) Primary spermatocytes
B) Secondary spermatocytes
C) Spermatozoa
D) Spermatids

51. **Treponema palladium causes?**
A) AIDS
B) Genital herpes
C) Syphilis
D) Gonorrhea

52. **What is the location of interstitial cells in testes?**
A) Inside the seminiferous tubules
B) Between the seminiferous tubules
C) Among the germinal epithelial cells
D) Around the testes

53. **A type of cells in human testes which produce testosterone are called?**
A) Germ cells
B) Sertoli cells
C) Interstitial cells
D) Spermatocytes

54. **The hormone produced from corpus luteum is:**
A) Prolactin
B) FSH
C) Progesterone
D) LH

55. **The length of myofibril from one Z-band to the next is described as:**
A) Sarcolemma
B) Sarcoplasm
C) Sarcomere
D) Muscle fiber

56. **The Ca^{++} ions released during a muscle fiber contraction attach with:**
A) Myosin
B) Actin
C) Troponin
D) Tropomyosin

57. **The joint that allows the movement in several directions is called:**
A) Hinge joint
B) Ball and Socket joint
C) Cartilagous joint
D) Fibrous joint

58. **Where can we find H zone in the figure of fine structure of skeletal muscle's myofibril?**
A) In the mid of A band
B) In I-band
C) Besides the Z-line
D) Along the I-band

59. **First vertebra of cervical region of vertebral column is known as:**
A) Atlas
B) Sacral
C) Thoracic
D) Axis

60. **Chemically insulin and glucagon are:**
A) Carbohydrates
B) Proteins
C) Lipids
D) Nucleic acids

61. **Hormones secreted by anterior pituitary and which controls the secretion of hormones of other endocrine glands are known as:**
A) Release factor
B) Inhibitor
C) Accelerator
D) Tropic or trophic hormones

62. **Alpha cells of Islets of Langerhans secrete hormone called:**
A) Glucocorticoid
B) Insulin
C) Glucagon
D) Aldosterone

63. **Which of the following is the function of glucagon hormone?**
A) Glucose to lipids
B) Glucose to proteins
C) Glucose to glycogen
D) Glycogen to glucose

64. **In passive immunity which of the following components are injected into body?**
A) Antigens
B) Immunogens
C) Serum
D) Immunoglobulins

65. Which part of the antibody recognizes the antigen during immune response?
A) Heavy part
B) Variable part
C) Light part
D) Consonant part

66. Two identical light chains and two identical heavy chains in antibody molecule are linked by:
A) Disulphide bridges
B) Peptide bond
C) Glycerol bond
D) Ionic bond

67. Antibodies are produced against invading cells by:
A) Lymphocytes
B) Basophils
C) Basophils
D) Neutrophils

68. In the structural diagram of an antibody molecule which portion is occupied by variable chains?
A) Lower region
B) Upper region
C) Middle region
D) In between chains

69. Every molecule of NADH, fed into ETC produces:
A) 2 ATP
B) 3 ATP
C) 4 ATP
D) 6 ATP

70. Final acceptor of electrons in respiratory chain is:
A) Cytochrome a
B) Oxygen
C) Cytochrome a^3
D) Cytochrome c

71. The end product of anaerobic respiration in humans and other mammals is:
A) Pyruvic acid
B) Ethanol
C) Lactic acid
D) Glucose

72. A biochemical process which occurs within a cell to breakdown complex compounds to produce energy is called:
A) Respiration
B) Photosynthesis
C) Oxidation reduction
D) Photophosphorylation

73. Which part of chlorophyll molecule absorbs light?
A) Phytol
B) Porphyrin ring
C) Pyrrole
D) Thylakoid membrane

74. The DNA molecule formed from messenger-RNA by reverse transcriptase is called??
A) Complementary DNA
B) Recombinant DNA
C) Chimeric DNA
D) Plasmid DNA

75. The agent which separates the two strands of DNA in PCR is??
A) DNA ligase
B) Primer
C) Heat
D) Helicase

76. Cystic fibrosis patient lack a gene that codes for trans-membrane carrier of??
A) Na^+ ions
B) Cl^- ions
C) Ca^{++} ions
D) K^+ ions

77. The phage commonly used as a vector in genetic engineering is?
A) Lambda phage
B) Gamma phage
C) T_2 phage
D) T_4 phage

78. Restriction endonucleases are naturally occurring enzymes of:
A) Viruses
B) Bacteria
C) Fungi
D) Plants

79. In an ecosystem mycorrhizae are an example of:
A) Predation
B) Symbiosis
C) Mutualism
D) Parasitism

80. As a result of destruction of ozone layer there is significant increase in:
A) Ultra-violet radiations
B) Greenhouse gases
C) Nitrogen oxide
D) Sulphur oxide

81. Higher rate of a biological activity in a nutrient rich pond water is called:
A) Water pollution
B) Air pollution
C) Eutrophication
D) Industrial effects

Living part of ...

82. A) Lithosphere
B) Hydrosphere
C) Community
D) Biosphere

83. **A living association between two living organisms of different species which is beneficial to both the partners is called:**
A) Commensalism
B) Parasitism
C) Mutualism
D) Predation

84. **The structures which are reduced during the course of evolution and have no apparent function are called:**
A) Regenerated organs
B) Vestigial organs
C) Saltatory organs
D) Useless organs

85. **When a gene suppresses the effect of another gene at another locus the phenomenon is termed as:**
A) Over dominance
B) Pleiotropy
C) Epistasis
D) Co-dominance

86. **Phenylketonuria is an example of:**
A) Polyploidy
B) Transmutation
C) Inversion
D) Point mutation

87. **A situation in which one gene affects two or more unrelated characters is called:**
A) Epistasis
B) Pleiotropy
C) Dominance relation
D) Polygenes

88. **The mutation which causes change in the sequence of DNA is called:**
A) Point mutation
B) Chromosomal mutation
C) Deletion
D) Inversion

Answers :

1.	B	2.	D	3.	B	4.	C	5.	D	6.	B	7	B	8.	D	9.	A	10.	B
11	A	12	D	13	A	14	A	15	D	16	B	17	A	18	B	19	A	20	B
21	D	22	B	23	D	24	D	25	A	26	B	27	B	28	A	29	A	30	D
31	A	32	C	33	A	34	C	35	A	36	A	37	D	38	A	39	B	40	A
41	A	42	D	43	D	44	D	45	C	46	D	47	A	48	C	49	C	50	A
51	C	52	B	53	C	54	C	55	C	56	C	57	B	58	A	59	A	60	B
61	D	62	C	63	D	64	D	65	B	66	A	67	A	68	B	69	B	70	B
71	C	72	C	73	B	74	A	75	C	76	B	77	A	78	B	79	B	80	A
81	C	82	D	83	C	84	B	85	C	86	D	87	B	88	A				

ENTRANCE TEST – 2014

BIOLOGY

1. **The use of living organisms in industry for the production of useful products is known as**
   A) Parasitology
   B) Biochemistry
   C) Biotechnology
   D) Molecular Biology
2. **Plants having foreign DNA incorporated into their cells are called:**
   A) Clone plants
   B) Transgenic plants
   C) Parthenocarpic plants
   D) Mutant giants
3. **Treatment by using attenuated culture of bacteria is called**
   A) Chemotherapy
   B) Sterilization
   C) Antisepsis
   D) Vaccination
4. **The major cause of hepatitis B is**
   A) Blood transfusion
   B) Blood clotting
   C) Absence of fibrinogen
   D) Contaminated soil
5. **During animal cell division, the spindle fibres are formed from**
   A) Mitochondria
   B) Centrioles
   C) Ribosomes
   D) Lysosomes
6. **Which component of the cell is concerned with cell secretions?**
   A) Plasma membrane
   B) Golgi complex
   C) Cytoskeleton
   D) Mitochondria
7. **During which period of interphase (cell cycle) DNA is synthesized?**
   A) G_1
   B) G_2
   C) S
   D) G_0
8. **Peptidoglycan or murein is a special or distinctive feature of cell wall in**
   A) Algae
   B) Fungi
   C) Bacteria
   D) Plants
9. **In mitochondria, small knob-like structures called F1 particles are found in:**
   A) Outer membrane
   B) Outer compartment
   C) Inner membrane
   D) Inner compartment
10. **The most critical phase of mitosis which ensures equal distribution of chromatids in the daughter cells is**
    A) Prophase
    B) Metaphase
    C) Anaphase
    D) Telophase
11. **Non-disjunction of 21st pair of chromosomes in one of the gamete leads to 47 chromosomes in one individual. This condition is called**
    A) Turner's syndrome
    B) Klinefelter's syndrome
    C) Down's syndrome
    D) Jacob's syndrome
12. **The intake of liquid materials across the cell membrane is**
    A) Phagocytosis
    B) Endocytosis
    C) Pinocytosis
    D) Exocytosis
13. **Which one of the following is the site of oxidative phosphorylation in mitochondria?**
    A) Cristae
    B) Matrix
    C) Outer membrane
    D) Ribosomes
14. **Organelle involved in the synthesis of ATP is**
    A) Ribosome
    B) Mitochondria
    C) Nucleus
    D) Centriole
15. **The most common respiratory substrate as a source of energy is**
    A) Glucose
    B) Sucrose
    C) Fructose
    D) Insulin
16. **The simplest monosaccharide containing keto group is**
    A) Glyceraldehyde
    B) Dihydroxy acetone
    C) Glucose
    D) Ribose

17. If the genetic code is made up of three nucleotides, then total possible genetic codes will be
A) 4
B) 20
C) 64
D) 61

18. Waterproof surfaces like cuticle of leaf and protective covering of an insect's body are
A) Phospholipids
B) Waxes
C) Terpenoids
D) Acylglycerols

19. In translation the terminating codon is
A) GUA
B) UAA
C) UUG
D) AGU

20. All co-enzymes are derived from
A) Proteins
B) Carbohydrates
C) Metal ions
D) Vitamins

21. The competitive inhibitors have structural similarity with
A) Active site
B) Binding site
C) Substrate
D) Co-enzyme

22. Which one of the following is the optimum pH of pancreatic lipase enzyme?
A) 7.60
B) 8.00
C) 9.00
D) 9.70

23. A co-factor tightly bound to the enzyme on the permanent basis is called
A) Activator
B) Co-enzyme
C) Prosthetic group
D) Apo-enzyme

24. Which one of the following cells are mainly infected by HIV?
A) T-killer lymphocytes
B) T-helper lymphocytes
C) B-plasma cells
D) B-memory cells

25. Which one of the following antibiotic causes permanent discoloration of teeth in young children if it is misused?
A) Penicillin
B) Streptomycin
C) Sulfonamide
D) Tetracycline

26. What are the sequence of steps in which a bacteriophage attacks bacteria and injects its DNA?
A) Landing → Tall contraction → Penetration → DNA Injection
B) Penetration → Landing → Tall contraction → DNA Injection
C) Tall contraction → Landing → DNA Injection → Penetration
D) Landing → Penetration → Tall contraction → DNA Injection

27. Athlete's Foot is a disease caused by
A) Bacteria
B) Virus
C) Fungus
D) Arthropod

28. Ascaris is which one of the following?
A) Ectoparasite
B) Intestinal parasite
C) Respiratory tract parasite
D) Urinogenital tract parasite

29. Polymorphism is a feature exhibited by members of
A) Coelenterates
B) Arthropoda
C) Porifera
D) Platyhelminthes

30. Which one of the following is the primary host of liver fluke?
A) Man
B) Sheep
C) Snail
D) Dog

31. Which one of the following is an example of a free living carnivorous flatworm?
A) Liver fluke
B) Dugesia
C) Tapeworm
D) Schistosoma

32. The sources of staple food for man are plants which belong to the family:
A) Mimosaceae
B) Poaceae
C) Rosaceae
D) Fabaceae

3. In human, Escherichia coli is involved in the formation of
A) Calcium
B) Vitamin D
C) Vitamin A
D) Vitamin K

4. **The function of Goblet cells is to secrete**
A) Gastrin
B) Hydrochloric acid
C) Pepsinogen
D) Mucus

5. **Gastric glands are composed of __types of cells**
A) Two
B) Three
C) Four
D) Five

6. **HCl in gastric juice is secreted by which one of the following cells?**
A) Chief cells
B) Oxyntic cells
C) Mucous cells
D) Kupffer cells

7. **Histamine is produced by which one of the following cells?**
A) Basophils
B) Platelets
C) Monocyte
D) Eosinophils

8. **Which one of the following is the most numerous / commonest of white blood cells?**
A) Eosinophils
B) Monocytes
C) Neutrophils
D) Lymphocytes

9. **The oxygenated blood from lungs to heart is transported by the**
A) Pulmonary artery
B) Coronary artery
C) Pulmonary vein
D) Hepatic artery

10. **Which one of the following proteins takes part in blood clotting?**
A) Prothrombin
B) Fibrinogen
C) Immunoglobulin
D) Globulin

11. **Which one of the following is responsible for the production of concentrated urine?**
A) Juxtamedullary nephrons
B) Cortical nephrons
C) Proximal tubule
D) Distal tubule

12. **Reabsorption of useful constituents normally takes place in which one of the following?**
A) Proximal tubule
B) Distal tubule
C) Bowman's capsule
D) Glomerulus

13. **Which one of the following parts of excretory system in humans acts as countercurrent multiplier?**
A) Kidney
B) Cortex
C) Medulla
D) Loop of Henle

14. **Anti-Diuretic Hormone (ADH) is released from**
A) Anterior pituitary lobe
B) Posterior pituitary lobe
C) Hypothalamus
D) Thalamus

15. **Which one of the following is the main nitrogenous waste product in humans?**
A) Urea
B) Ammonia
C) Salts
D) Uric acid

46. **The right and left cerebral hemispheres are connected by a thick band of nerve fibres called:**
A) Medulla
B) Corpus callosum
C) Pons
D) Hippocampus

47. **The part of the brain which guides smooth and accurate motions and maintains body position is called**
A) Cerebrum
B) Cerebellum
C) Pons
D) Medulla

48. **Which one of the following is the effect of sympathetic nervous system?**
A) Constriction of bronchi
B) Decrease in heart rate
C) Promotes digestion or peristalsis
D) Dilates the pupil

49. **High levels of aluminium may contribute to the onset of which one of the following?**
A) Parkinson's disease
B) Epilepsy
C) Alzheimer's disease
D) Gonorrhea

50. Testoste... by which one of the following?
A) Sertoli cells
B) Germinal epithelium
C) Interstitial cells
D) Spermatogonia

51. The oocyte released during ovulation is in
A) Anaphase I
B) Prophase I
C) Metaphase I
D) Metaphase II

52. Yellowish glandular structure formed after the release of egg from follicle is called
A) Corpus callosum
B) Graafian follicle
C) Corpus luteum
D) Follicle atresia

53. On puberty, the development of primary follicles is stimulated by
A) ICSH
B) FSH
C) LH
D) Estrogen

54. Causative agent of a sexually transmitted disease that affects mucous membrane of the urinogenital tract is
A) Staphylococcus aureus
B) Treponema pallidum
C) Neisseria gonorrhoeae
D) Escherichia coli

55. In a human vertebral column, the number of____vertebrae is 7.
A) Cervical
B) Thoracic
C) Lumber
D) Sacrum

56. Which one of the following structures holds the bones together?
A) Joints
B) Cartilages
C) Fibrous capsules
D) Ligaments

57. Which one of the following cartilages is the most abundant in the human body?
A) Elastic cartilage
B) Chondrous cartilage
C) Fibrous Cartilage
D) Hyaline Cartilage

58. The repeated protein pattern of myofibrils is called
A) Sarcomere
B) Zyomere
C) Sarcolemma
D) Cross bridges

59. When more energy is required in muscle contraction then that energy can also be produced by _____ as a secondary source.
A) Glucose
B) Phosphocreatine
C) Fructose
D) Lactic acid

60. Which one of the following is a steroid hormone?
A) Glucagon
B) Thyroxine
C) Epinephrine
D) Oestrogen

61. The gonadotrophic hormones of anterior lobe of pituitary include:
A) Prolactin, Thyroid Stimulating Hormone, Somatotrophin Hormone
B) Follicle Stimulating Hormone, Luteinizing Hormone, Prolactin
C) Adrenocorticotrophic Hormone, Luteinizing Hormone, Follicle Stimulating Hormone
D) Luteinizing Hormone, Follicle Stimulating Hormone, Thyroid Stimulating Hormone

62. Over-activity of cortical hormone of adrenal gland causes
A) Addison's disease
B) Parkinson's disease
C) Cushing's disease
D) Down's syndrome

63. How many iodine atoms are present in thyroxine?
A) 3
B) 4
C) 2
D) 5

64. T-lymphocytes recognize antigen and attack microorganisms or transplanted organ and tissues. This effect is called
A) Cell-mediated response
B) Humeral immune response
C) Active immunity
D) Passive immunity

65. Which part of antibody recognizes the antigen during immune response?
A) Heavy part
B) Light part
C) Constant part
D) Variable part

66. **What type of immunity is achieved by injecting antibodies, antiserum, anti-venom serum?**
A) Active immunity
B) Passive immunity
C) Artificially induced immunity
D) Naturally induced immunity

67. **Which one of the following glands is involved in the production of lymphocytes?**
A) Pineal
B) Pituitary
C) Thymus
D) Adrenal

68. **Antibodies are proteins and made up of how many polypeptide chains?**
A) One
B) Two
C) Three
D) Four

69. **Oxidative phase of glycolysis starts with dehydrogenation of**
A) Glycolysis
B) Ribulose Bisphosphate
C) Glyceraldehyde 3-phosphate
D) NADH

70. **In one turn, the Krebs's cycle produces one molecule of ATP, one molecule of $FADH_2$ and _____ molecules of NADH**
A) 1
B) 2
C) 3
D) 4

71. **Which one of the following is the stage of cellular respiration for which oxygen is not essential?**
A) Glycolysis
B) Pyruvate oxidation
C) Krebs's cycle
D) Electron Transport Chain

72. **Pyruvate, the end product of glycolysis moves from cytosol to mitochondrial matrix where it is oxidized into___producing CO_2 as a by-product.**
A) Acetic acid (active)
B) Citrate
C) NAD
D) FAD

73. **Pyruvate** $\xrightarrow{?}$ **Acetyl CoA**
A) $FAD^+ \rightarrow FADH$
B) $NAD^+ \rightarrow NADH$
C) $NADH \rightarrow NAD + H^+$
D) $FADH^+ \rightarrow FAD + H^+$

74. **pBR 322 have antibiotic resistance gene for**
A) Ampicillin and aspirin
B) Streptomycin and metronidazole
C) Ampicillin and Tetracycline
D) Penicillin and metronidazole

75. **Cystic Fibrosis affects which one of the following cells of the body?**
A) Epithelial cells
B) Endothelial cells
C) Plasma cells
D) Blood cells

76. **The enzymes which act as molecular scissors in recombinant DNA technology is**
A) Exonucleoses
B) Endonucleoses
C) Polymerases
D) Reverse transcriptases

77. **Which of the following is the correct sequence of PCR?**
A) Heating → Cooling → Add Primer → Copying of strand
B) Heating → Add Primer → Cooling → Copying of strand
C) Add Primer → Heating → Cooling → Copying of strand
D) Cooling → Add Primer → Heating → Copying of strand

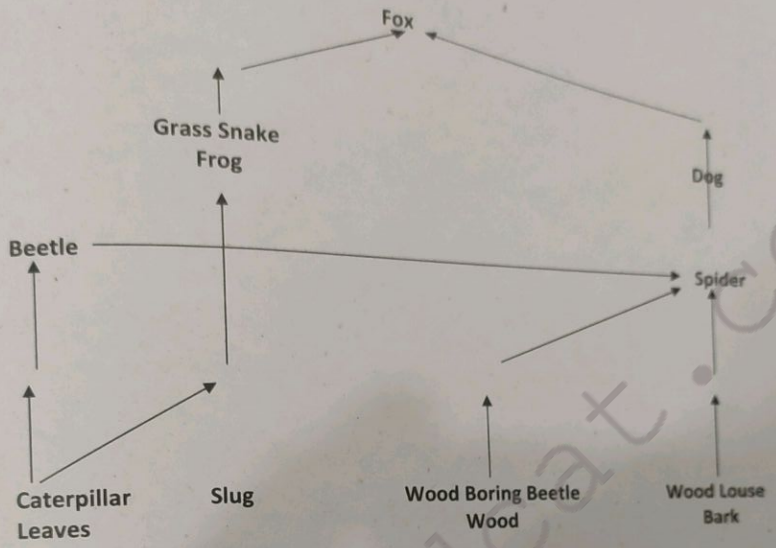
78. **When two different pieces of DNA are joined together, the result is which one of the following?**
A) Complementary DNA
B) Mutated DNA
C) Recombinant DNA
D) Cloned DNA

79. **Individual successions are known as**
A) Primary successions
B) Secondary successions
C) Seres
D) Xeroses

80. **Which one of the following is the ultimate distributional unit within which a species is restrained by the limitations of its physical structure and physiology?**
A) Niche
B) Biome
C) Ecosystem
D) Habitat

81. All herbivores belong to which trophic level in the food chain?
A) T1
B) T2
C) T3
D) T4

82. How many food chains are present in following food web?



A) 5
B) 3
C) 6
D) 4

83. The relationship in which one organism gets benefit and the other is not affected is called
A) Mutualism
B) Commensalism
C) Predation
D) Parasitism

84. When a gene expresses the effects of a gene at another focus, this is known as
A) Epistasis
B) Co-dominance
C) Complete dominance
D) Mutation

85. In male the sex determining gene is
A) XY
B) SRY
C) SYX
D) SXX

86. A gene which affects two or more unrelated characteristics is called
A) Pleiotropic
B) Epistatic
C) Dominant
D) Mutant

87. Position of a gene within a DNA molecule is
A) Locus
B) Origin
C) Amplicon
D) Filial

88. Sickle cell anemia is a type of
A) Insertion
B) Transposition
C) Deletion
D) Base Substitution

1.	C	2.	B	3.	D	4.	A	5.	B	6.	[illegible]	7.	[illegible]	8.	[illegible]	9.	[illegible]	10.	C
11	C	12	C	13	A	14	B	15	A	16	B	17	C	18	B	19	B	20	D
21	C	22	C	23	C	24	B	25	D	26	A	27	C	28	B	29	B	30	B
31	B	32	B	33	D	34	D	35	B	36	B	37	A	38	D	39	C	40	B
41	A	42	A	43	D	44	B	45	A	46	B	47	B	48	D	49	C	50	C
51	D	52	C	53	B	54	C	55	A	56	D	57	D	58	A	59	B	60	D
61	B	62	C	63	A	64	B	65	D	66	B	67	C	68	D	69	C	70	C
71	A	72	A	73	B	74	C	75	A	76	B	77	A	78	C	79	C	80	A
81	B	82	D	83	B	84	A	85	B	86	A	87	A	88	D				

ENTRANCE TEST – 2015

BIOLOGY

1. **In___response, β-cells produce plasma cells that synthesize antibodies and release in blood plasma and tissue fluid.**
   A) Cell-Mediated
   B) Hormonal
   C) Humoral
   D) Phototactic
2. **Passive immunity is used against:**
   A) Malaria
   B) Typhoid
   C) Dengue
   D) Tetanus
3. **B-lymphocytes are named due to their relationship with:**
   A) Blood
   B) Bursa of Fabricius
   C) Bone Marrow
   D) Bile Duct
4. **In light independent stage of photosynthesis, the CO2 combines with____to form an unstable 6-carbon intermediate.**
   A) Ribulose bisphosphate
   B) Hexose sugar
   C) Glycerate-3-phosphate
   D) Glyceraldehyde-9-phosphate
5. **In glycolysis, glycerate-1,3-bisphosphate is converted into glycerate-3-phosphate by losing _____phosphate molecules.**
   A) 3
   B) 2
   C) 1
   D) 4
6. **Malate is oxidized by_____to oxaloacetate in Krebs's Cycle.**
   A) ATP
   B) NADP
   C) NAD
   D) FAD
7. **In electron transport chain, the electrons from NADH and FADH2 are passed to;**
   A) Cytochrome a
   B) Cytochrome a3
   C) Co-enzyme c
   D) Co-enzyme Q
8. **Carriers of the respiratory chain are located on:**
   A) Matrix of mitochondria
   B) Outer membrane of mitochondria
   C) Inner membrane of mitochondria
   D) Cytoplasmic matrix
9. **In cystic fibrosis, liposomes-microscopic vesicles are sued which are coated with:**
   A) Healthy Gene
   B) Chromosome
   C) Protein
   D) Carbohydrate
10. **The DNA formed by the reverse transcription is called:**
    A) rDNA
    B) dDNA
    C) cDNA
    D) DNA
11. **Bacterial cells take up recombinant plasmids when they are treated with:**
    A) $CaCl_2$
    C) KCl

D) NaOH

12. Which one of the following is made up of radioactively labelled nucleotides?
A) Phage DNA
B) Genomic Library
C) Recombinant DNA
D) Gene Probe

13. A technique in transgenic animals in which desired gene is inserted into the eggs of animal is called:
A) Embryonic Stem Cell mediated Transfer
B) Microinjection
C) Retro-virus mediated gene Transfer
D) Virus vectors

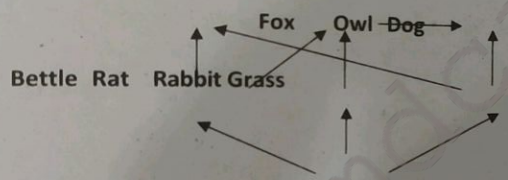
14. Ozone is a layer of atmosphere extending from_____km above earth and absorbs ultraviolent radiations.
A) 10-50
B) 50-60
C) 5-30
D) 10-80

15. Light rays from the sun are absorbed by CO_2 and re-radiate as__ radiations.
A) Ultraviolent
B) Indigo
C) Infra-Red
D) Green

16. The gases which are produced by burning of fossils fuels and are responsible for acid rain are:
A) CFCs
B) CO_2 and CO
C) HCl and Oxides of Nitrogen
D) SO_2 and Oxides of Nitrogen

17. During successions, the first organisms that develop on bare rock are:
A) Lichens
B) Shrubs
C) Moss
D) Herbs

18. Trophic level of a herbivore in given food-web is:



A) 1
B) 3
C) 4
D) 2

19. During maternal mitosis, non-disjunction of autosomal chromosome pair results in the formation of an egg having 24 chromosomes in:
A) Klinefelter's Syndrome
B) Down's Syndrome
C) Turner's Syndrome
D) Jacob's Syndrome

20. Typical symptoms like enlarged breasts and small testis in male are attributed to:
A) Down's Syndrome
B) Turner's Syndrome
C) Klinefelter's Syndrome
D) Phenylketonuria

21. Fluid mosaic model of plasma membrane states that protein molecules float in a fluid _____ layer.
A) Galactose
B) Phospholipids
C) Glucose
D) Carbohydrate

22. How many triplets of microtubules are present in centriole?
A) Ten
B) Eight
C) Nine
D) Seven

23. Turner's syndrome is characterized by having:
A) Trisomy 21
B) 44 + XXY
C) Trisomy 18
D) 44 + XO

24. Which one of the following cell structure is involved in the synthesis of lipids?
A) Endoplasmic Reticulum
B) Golgi Complex
C) Centriole
D) Mitochondria

25. Monosaccharides are major components of:

A) DNA, ATP, Ribulose bisphosphate and Cyst...
B) DNA, NAD and Insulin
C) DNA, NADP, ATP and Ribulose bisphosphate
D) DNA, RNA and Myosin

26. **Blood group antigen contains:**
A) Glycoproteins
B) Phospholipids
C) Glycolipids
D) Sphingolipids

27. **Myosin is a _____type of protein.**
A) Intermediate
B) Simple
C) Globular
D) Fibrous

28. **Which one of the following is an example of unsaturated fatty acid?**
A) Butyric Acid
B) Oleic Acid
C) Palmitic Acid
D) Acetic Acid

29. **Number of base pairs in one turn of DNA is:**
A) 10
B) 2
C) 34
D) 54

30. **The lymph vessel of villi is called:**
A) Epithelium
B) Afferent lymph vessel
C) Adrenals
D) Lacteal

31. **Right atrium is separated from right ventricle by:**
A) Bicuspid Valve
B) Semilunar Valve
C) Tricuspid Valve
D) Interatrial Septum

32. **The flaps of tricuspid valves are attached to muscular extensions of right ventricle known as:**
A) Smooth Muscles
B) Papillary Muscles
C) Intercostal Muscles
D) Skeletal Muscles

33. **One complete heart beat consists of one systole and one diastole and lasts for about:**
A) 0.8 sec
B) 0.2 sec
C) 0.4 sec
D) 0.5 sec

34. **The heart beat cycle starts when electric impulses are generated from;**
A) AV Node
B) SV Node
C) SA Node
D) PQ Node

35. **About 70-85% CO2 in blood is carried:**
A) As carboxylase myoglobin
B) With proteins in plasma
C) Freely as CO2
D) As bicarbonate

36. **Those nephrons which are present along the border of the cortex and medulla are called:**
A) Juxtamedullary nephrons
B) Cortical nephrons
C) Internal nephrons
D) Outer nephrons

37. **When water is in short supply, increased water retention occurs through the:**
A) Cortical nephrons
B) Proximal Convoluted Tubule
C) Juxtamedullary nephrons
D) The tissue of cortex

38. **In nephrons, counter-current multiplier occurs at:**
A) Loop of Henle
B) Collecting Duct
C) Bowman's Capsule
D) Glomerulus

39. **Ascending loop of Henle does not allow outflow of:**
A) Na^+ ions
B) K^+ ions
C) Cl^- ions
D) Water

40. **A larger quantity of dilute urine is produced in diabetes insipidus. This disease is due to the deficiency of:**
A) Antidiuretic Hormone
B) Aldosterone
C) Thyroxine
D) Cortisol

41. **Water and sodium ions are reabsorbed in:**
A) Urinary Bladder and Urethra
B) Ureter
C) Adrenal Cortex
D) Proximal Convoluted Tubule & Collecting Duct

42. **Which disease is responsible for dementia (memory loss)?**
A) Parkinson's Disease
B) Alzheimer's Disease
C) Epilepsy
D) Grave's Disease

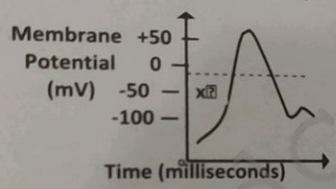
43. **Neurotransmitter secreted at synapse outside the central nervous system is:**
A) Dopamine
B) Polypeptide
C) Androgen
D) Acetylcholine

44. **Conduction of action potentials from one node of Ranvier to another in myelinated neurons is through:**
A) Hyperpolarization
B) Resting Membrane Potential
C) Depolarization
D) Saltatory Conduction

45. **In human testis, which structure is responsible for carrying sperm from inside the testis?**
A) Seminiferous tubules
B) Urinogenital duct
C) Seminal Vesicles
D) Vasa efferentia

46. **In which part of female reproductive system fertilization takes place?**
A) Proximal part of oviduct
B) Uterus
C) Placenta
D) Vagina

47. **In the following diagram of action potential in a neuron, 'x' depicts:**



A) Depolarization
B) Polarization
C) Repolarization
D) Hyperpolarization

48. **In females, FSH stimulates the ovary to produce:**
A) Progesterone
B) Lactin
C) Oestrogen
D) Oxytocin

49. **Syphilis, sexually transmitted disease is caused by:**
A) HIV
B) Treponema pallidum
C) Neisseria gonorhoeae
D) Type '2' virus

50. **In which phase of human female menstrual cycle, endometrium prepares for the implantation of embryo?**
A) Proliferative phase
B) Menstrual phase
C) Secretory phase
D) Ovulation phase

51. **The total number of cervical and thoracic vertebrate in human vertebral column is:**
A) 7
B) 19
C) 14
D) 33

52. **A sarcomere is the region of a myofibril between two successive:**
A) M-lines
B) Z-lines
C) I-bands
D) T-tubules

53. **The sarcolemma of muscle fibre folds inwards and forms a system of tubes which runs through the sarcoplasm called:**
A) Myofilaments
B) Sarcoplasmic reticulum
C) Z-lines
D) Transverse tubules

54. **According to sliding filament theory, when muscle fibers are stimulated by nervous system, which of the following changes occurs?**

A) I-bands shorten
B) H-zone becomes more visible
C) Z-lines move further apart
D) A-bands shorten

55. **If lactic acid build up in thigh muscles, it causes muscle tiredness and pain. This condition is called:**
A) Muscle Fatigue
B) Tetany
C) Cramps
D) Oxygen debt in muscles

56. **Thyroxine deficiency in adults' results in a condition called:**
A) Cretinism
B) Hypothyroidism
C) Thyrotoximia
D) Myxoedema

57. **α-cells of pancreas secrete a hormone known as:**
A) Glucagon
B) Insulin
C) Gastrin
D) Rennin

58. **X-linked recessive trait is:**
A) Hypophosphatemia
B) Vitamin-D resistant rickets
C) Haemophilia
D) Diabetes Mellitus

59. **Human skin colour is a good example of?**
A) Sex-linked inheritance
B) Polygenic inheritance
C) X-linked inheritance
D) y-linked inheritance

60. **From evolutionary point of view, which respiratory protein is common in many organisms?**
A) Cytochrome a
B) Cytochrome b
C) Cytochrome c
D) Cytochrome d

61. **Number of pairs of autosomes in humans in:**
A) 23
B) 24
C) 21
D) 22

62. **ABO blood system is an example of:**
A) Polygenes
B) Multiple genes
C) Multiple Alleles
D) Multiple Mutation

63. **Which molecular structure of enzyme is essential for activity of enzyme?**
A) Primary Structure
B) Quaternary Structure
C) Secondary Structure
D) Tertiary Structure

64. **Which one of the following edible products is widely pasteurized?**
A) Soft drinks
B) Mango squash
C) Milk
D) Orange Juice

65. **Ribosomes are tiny organisms, which are involved in the synthesis of:**
A) Protein
B) RNA
C) Nucleus
D) Nucleosome

66. **Which organelle is bounded by two membranes?**
A) Ribosome
B) Mitochondria
C) Lysosome
D) Nucleolus

67. **At the beginning of nuclear division, the number of microtubule triplets in two pairs of centrioles that migrate to opposite poles are:**
A) 9
B) 18
C) 108
D) 36

68. **The disease in which an individual has extra sex chromosome (44 + XXY) is known as:**
A) Down's syndrome
B) Tuner's syndrome
C) Klinefelter's syndrome
D) Jacob's syndrome

69. **Over-secretion of cortical hormone causes a disease called;**
A) Cushing's Disease
B) Diabetes Mellitus
C) Hypoglycemia
D) Addison's Disease

70. **Ejection of milk from mammary glands is under the control of which one of the following hormones?**
A) Androgen
C) Progesterone

B) Oxytocin
D) Estrogen

71. **Granulocytes are:**
A) Monocytes, Eosinophils, Basophils
B) Basophils, Macrophages, Neurophils
C) Neurophils, Eosinophils, Basophils
D) Monocytes, Macrophages, Basophils

72. **Response of body against the transplanted organ is:**
A) Homeostatic Response
B) Behavioral Response
C) Primary Response
D) Cell-mediated Response

73. **Some enzymes require helper which is non-protein part for its efficient functioning that is called:**
A) Accelerator
B) Cofactor
C) Prosthetic group
D) Apoenzyme

74. **Pepsin, protein digesting enzymes, sets best pH:**
A) 3.00
B) 4.50
C) 2.00
D) 6.00

75. **Which one of the following is an example of competitive inhibitor?**
A) Glucose
B) Fumerate
C) Succinic Acid
D) Melonate

76. **HIV is classified as:**
A) Bacteriophage
B) Oncovirus
C) Retrovirus
D) Icosahedral virus

77. **Cyanobacteria are:**
A) Photoautotrophic bacteria
B) Chemosynthetic bacteria
C) Saprotrophic bacteria
D) Parasitic bacteria

78. **During favourable conditions, certain bacteria produces:**
A) Ribosomes
B) Plasmids
C) Mitochondria
D) Spores

79. **In rhizopus, zygote forms temporary, dormant, thick-walled resistant structure called:**
A) Zygospore
B) Spore
C) Sporangia
D) Hydra

80. **_____is a triploblastic organism.**
A) Jelly Fish
B) Sea Anemone
C) Tapeworm
D) Corals

81. **In arthropods, the body cavity is in the form of:**
A) Coelem
B) Haemocoel
C) Pseudocoelem
D) Enteron

82. **_____is a good example of polymorphism.**
A) Hydra
B) Starfish
C) Obelia
D) Euplectella

83. **Name common gut roundworm parasite of human and pigs.**
A) Aascaris lumberocoides
B) Lumbericus terresaris
C) Pheretima posthuma
D) Hirudo Medicinalis

84. **_____is also called liver fluke.**
A) Dugesia
B) Taenia
C) Fasciola
D) Coral

85. **Oxyntic cells in stomach produces:**
A) Pepsin
B) Pepsinogen
C) Gastrin
D) HCl

86. **The hormone which inhibits the secretion of pancreatic juice is:**
A) Secretin
B) Gastrin
C) Thyroxine
D) Parathormone

87. **Trypsinogen is activated to trypsin by:**
A) HCl
C) Mucus

D) Gastrin

88. **The emulsification of fats is the role of:**
A) Saliva
B) Pancreatic juice
B) Enterokinase
C) Gastrin
D) Bile

Answers :

1.	C	2.	D	3.	B	4.	A	5.	C	6.	C	7	D	8.	C	9.	A	10.	C
11	A	12	D	13	B	14	A	15	C	16	D	17	A	18	D	19	B	20	C
21	B	22	C	23	D	24	C	25	B	26	A	27	D	28	B	29	A	30	D
31	C	32	B	33	A	34	C	35	D	36	A	37	C	38	A	39	D	40	A
41	D	42	B	43	D	44	D	45	D	46	A	47	A	48	C	49	B	50	C
51	B	52	B	53	D	54	A	55	A	56	D	57	A	58	C	59	B	60	C
61	D	62	C	63	D	64	C	65	A	66	B	67	D	68	C	69	A	70	B
71	C	72	D	73	B	74	C	75	D	76	C	77	A	78	D	79	A	80	C
81	B	82	C	83	A	84	C	85	D	86	A	87	B	88	D				

ENTRANCE TEST – 2016

BIOLOGY

1. **Random, uncontrolled activity of some cells in the brain leading to chaotic activity in both sensory and motor nerves causes patients of to see and hear different strange things.**
A) Epilepsy
B) Parkinson's Disease
C) Alzheimer's Disease
D) Huntington's Disease

2. **Part of hind brain responsible for the balance and equilibrium of body is called:**
A) Medulla
B) Cerebellum
C) Pons
D) Thalamus

3. **Events of menstrual cycle are regulated by the:**
A) Ethylene
B) Gonadotrophins
C) Auxins
D) Gibberellins

4. **Decrease of FSH and increase of estrogen cause pituitary gland to secrete:**
A) Somatotrophin
B) Luteinizing Hormone
C) Testosterone
D) Spermatogonium

5. **Transmission of Neisseria gonorrhea is best described by which one of the following?**
A) Oro-fecal Route
B) Unsafe Sex
C) Vector Borne
D) Droplet Infection

6. **Syphilis is caused by:**
A) Spirochete
B) Nostoc
C) Water blooms
D) Cyanobacteria

7. **AIDS is caused by:**
A) Bacteria
B) Virus
C) Fungi
D) Alga

8. **Brain is protected and enclosed in:**
A) Lumbar vertebrae
B) Coccyx
C) Vertebral column
D) Cranium

9. **Longest bone in the human skeleton is:**
A) Ulna
B) Fibula
C) Tibia
D) Femur

10. **Hips and shoulder joints are examples of:**

A) Hinge Joints
B) Ball and Socket Joints
C) Synovial Joints
D) Cartilaginous Joints

11. **In pelvic region of human body, sacrum is formed by the fusion of:**
A) 4 Vertebrae
B) 5 Vertebrae
C) 6 Vertebrae
D) 3 Vertebrae

12. **Each muscle fibre is surrounded by a modified cell membrane called:**
A) Sarcolemma
B) Sarcomere
C) Myosin Filament
D) Myofilament

13. **_____ hormone is antagonistic to insulin and causes increase in blood glucose level.**
A) Glucagon
B) Nor-epinephrine
C) Calcitonin
D) Thyroxine

14. **Beta cells of islets of Langerhans produce_____hormone.**
A) Glucagon
B) Insulin
C) Pancreatic Juice
D) Parathormone

15. **The central portion of adrenal gland (Adrenal Medulla) produces_____hormone.**
A) Aldosterone
B) Epinephrine
C) Androgen
D) Corticosterone

16. **_____ hormones are called fight and flight hormones as they prepare an organism to face stressful situation.**
A) Adrenaline, Aldosterone
B) Epinephrine, Nor-epinephrine
C) Cortisone, Oxytocin
D) Thyroxine, Nor-epinephrine

17. **B-cells release antibodies in blood plasma, tissue fluid and lymph. This kind of immune response is called:**
A) Cell Mediated Response
B) Humoral Response
C) Active Response
D) Compound Response

18. **The type of immunity in which antibodies are passed from one individual to another is called:**
A) Passive Immunity
B) Artificial Active Immunity
C) Natural Active Immunity
D) Humoral Immunity

19. **To combat the active infections of tetanus, rabies and snakes the ____ immunization is used:**
A) Active
B) Humoral
C) Active Artificial
D) Passive

20. **In antibody molecule, two heavy and two light chains are bonded by:**
A) Disulphide Bond
B) Monosulphide Bond
C) Hydrogen Bond
D) Ionic Bond

21. **Variable amino acid sequences in antibody molecule are found in_____.**
A) Both light chains only
B) Both heavy chains only
C) One heavy and one light chain
D) Both heavy and light chains

22. **Each_consists of a light gathering antenna complex and reaction center.**
A) Chlorophyll
B) Photosystem
C) Photon
D) Electron

23. **Photosystem I has chlorophyll a molecules which absorb maximum light of:**
A) 680 nm
B) 780 nm
C) 700 nm
D) 580 nm

24. **Cyclic flow or C4 photosynthesis produces:**
A) ATP and CO_2
B) ATP
C) Only CO_2
D) Only Oxygen

25. **Immediate product formed after CO_2 fixation in Calvin Cycle is:**
A) Unstable 6-carbon compound
B) Unstable 5-carbon compound
C) Unstable 4-carbon compound
D) Unstable 3-carbon compound m

26. **Functional group of chlorophyll a is:**
A) $-CH_3$
C) $-COOH$

C	
C	
D	
A	
C	
C	
B	
C	

B) —CHO
D) —OH

27. **The modified plasmid or phage DNA is called:**
A) Clone DNA
B) Recombinant DNA
C) cDNA
D) rDNA

28. **The rapid exchange of materials through carrier proteins across the plasma membrane is called:**
A) Passive Diffusion
B) Active Transport
C) Endocytosis
D) Facilitated Diffusion

29. **The inner membrane of mitochondria form extensive infoldings called:**
A) Cristae
B) Cisternae
C) Lamella
D) Bifidae

30. **Which one of the following organelle is found in both prokaryotic and eukaryotic cells?**
A) Centriole
B) Endoplasmic Reticulum
C) Nucleus
D) Ribosome

31. **The compounds which on hydrolysis yield polyhydroxy aldehyde or ketone subunits are:**
A) Lipids
B) Proteins
C) Polynucleotides
D) Carbohydrates

32. **Secondary structure of protein is found in:**
A) Trypsin
B) Keratin
C) Insulin
D) Glucagon

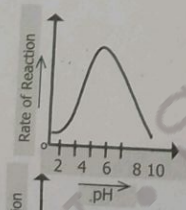
33. **Waxes are formed by combination of fatty acids with:**
A) Alcohol
B) Glycerol
C) Serine
D) Cysteine

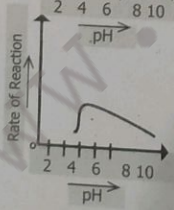
34. **Phosphodiester bond is:**
A) P—O—C—P—O—C
B) C—O—P
C) C—O—P—O—C
D) C—C—O—P

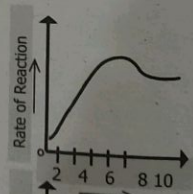
35. **An enzyme required Mg^{++} to catalyze the substrate. The Mg^{++} is best identifiedas:**
A) Prosthetic group
B) Activator
C) Co-enzyme
D) Inhibitor

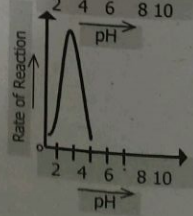
36. **According to_____ model the active site of enzyme is modified as the substrate interacts with enzyme.**
A) Induced fit
B) Lock and Key
C) Emil Fischer
D) Fluid Mosaic

37. **Which one of the following graphs shows how the rate of reaction of pepsin is affected by pH?**

A)


B)


C)


D)


38. **All viruses can reproduce within living organisms only, so they are known as:**
A) Ectoparasites
B) Endoparasites
C) Obligative Intracellular Parasites
D) Facultative Intracellular Parasites

39. **Many bacteria are motile due to presence of:**
A) Flagella
B) Pilli
C) Cilia
D) Microtubules

40. **_____ is an invagination of cell membrane which helps in cell division.**
A) Fimbriae
B) Nucleoid
C) Mesosome
D) Endospore

41. **_____ is the yeast that grows in the mucous membrane of mouth or vagina.**
A) Candida albicans
B) Saccharomyces cerevisiae
C) Aspergillus fumigatus
D) Aspergillus flavus

42. **Taenia is an endoparasite of human, pig and cattle which belongs to phylum.**
A) Cnidaria
B) Aschelminthes
C) Annelida
D) Platyhelminthes

43. **Body of_____consists of segments called proglottis which contains mainly sex organs.**
A) Planaria
B) Ascaris
C) Fasciola
D) Tapeworm

44. **_____ is a common parasite of the intestine of human and pig which belongs to phylum nematode.**
A) Taenia solanum
B) Schistosoma
C) Ascaris lumbriocoides
D) Fasciola hepatica

45. **In radial symmetry all body parts are arranged around the central axis. Radial symmetry represents__mode of life.**
A) Sessile
B) Streamlined
C) Active
D) Parasitic

46. **Pseudo-coelomates have a body cavity but it is not true coelom. Which one of the following is included in the group.**
A) Planaria
B) Tapeworm
C) Earthworm
D) Ascaris

47. **Digestion of__ starts in oral cavity due to the action of enzyme present in saliva.**
A) Starch
B) Cellulose
C) Fatty Acids
D) Polypeptides

48. **Food enters from stomach into small intestine through:**
A) Pyloric Sphincter
B) Cardiac Sphincter
C) Semilunar valve
D) Diaphragm

49. **_____ are the part of a gastric gland which produce hydrochloric acid.**
A) Parietal Cells
B) Goblet Cells
C) Chief Cells
D) Zymogen Cells

50. **Protein components of food are digested by the enzymatic secretion of:**
A) Goblet Cells
B) Parietal Cells
C) Zymogen Cells
D) Oxyntic Cells

51. **Digestive System consists of different layers, the innermost is known as:**
A) Submucosa
B) Mucosa
C) Muscularis
D) Serosa

52. **In human the closed sac which surrounds the heart is:**
A) Endocardium
B) Myocardium
C) Pericardium
D) Epicardium

53. **Chordae tendinae are fibrous cords attached with:**
A) Cardiac end of stomach valve
B) Tricuspid valve of heart
C) Pyloric sphincter of stomach
D) Eyelid

54. **Bicuspid valve controls the flow of blood from:**
A) Right atrium to right ventricle
B) Right ventricle to pulmonary artery
C) Left ventricle to aorta
D) Left atrium to left ventricle

55. **Carboxyhaemoglobin (10-20%) is formed when CO_2 combines with:**
A) Amino group of haemoglobin
B) Iron part of haemoglobin
C) Haem portion of haemoglobin
D) Plasma proteins

56. **Breathing consists of:**
A) Four phases
B) Three phases
C) One phase
D) Two phases

57. **Bowman's capsule continues as extensively convoluted portion known as:**
A) Peritubular capillaries
B) Proximal convuluted tubules
C) Efferent arterioles
D) Afferent arterioles

58. **Restriction endonucleases cleave the____of duplex DNA.**
A) Nitrogenous base
B) Base sugar
C) Phosphodiester bond
D) Hydrogen bond

59. **The enzyme which is responsible for the formation of bond between two double stranded DNA fragments is:**
A) Endonuclease
B) Urease
C) Ligase
D) Helicase

60. **The organisms of third trophic level are:**
A) Primary consumer
B) Primary producer
C) Tertiary consumer
D) Secondary consumer

61. **The ultimate source of energy in an ecosystem is:**
A) Photosynthesis
B) Sun
C) Plants
D) Water

62. **All the food chains and food webs begin with:**
A) Detritus
B) Herbivores
C) Green plants
D) Omnivores

63. **The change from bare rock or open area is rapid, especially in the initial stages and follows a series of recognizable and hence predictable stages. This process is called:**
A) Pioneers
B) Xerosere
C) Succession
D) Secondary succession

64. **The decline in the thickness of ozone layer is caused by:**
A) Increasing level of nitrogen oxide
B) Decreasing level of O_2
C) Decreasing level of CFCs
D) Increasing level of CFCs

65. **Which one of the following is considered as strong evidence of evolution?**
A) Embryology Record
B) Molecular Record
C) Biochemical Record
D) Fossil Record

66. **Structures found in different species which are believed to have a common evolutionary origin are called:**
A) Homologous
B) Analogous
C) Vestigial
D) Fossilized

67. **Which one of the following is X-linked trait?**
A) Male pattern baldness
B) Diabetes mellitus
C) Haemophilia
D) Erythroblastosis fetalis

68. **A character determined by three alleles is:**
A) Human skin colour
B) Human blood group
C) Human eye colour
D) Human Rh factor

69. **The total number of genes in a population is called:**
A) Gene pool
B) Allele pool
C) Genome
D) Genomic library

70. **_____ is the branch of Biology used for the identification and interpretation of fossils.**

A) Evolution
B) Paleontology
C) Zoogeography
D) Biodiversity

71. **Out of the given options, choose the one which shows the structures found only in plants**
A) Vacuole, Chloroplast, Ribosomes
B) Chloroplast, Microtubules, Peroxisomes
C) Chloroplast, Cell Wall, Vacuole
D) Chloroplast, Cell Wall, Mitochondria

72. **Presence of large central vacuole is the characteristic of:**
A) Prokaryotes
B) Protists
C) Fungi
D) Plants

73. **The basic structure of plasma membrane is provided by:**
A) Proteins
B) Cholesterols
C) Cytoskeleton
D) Phospholipids

74. **The organelle involved in detoxification of drugs and poisons in the liver cells is:**
A) Smooth Endoplasmic Reticulum
B) Rough Endoplasmic Reticulum
C) Golgi Apparatus
D) Lysosomes

75. **Down's syndrome is characterized by____at chromosome 21.**
A) Trisomy
B) Monosomy
C) Polysomy
D) Disomy

76. **Which of the following is an example of autosomal non-disjunction?**
A) Turner's Syndrome
B) Jacob's Syndrome
C) Metastasis
D) Down's syndrome

77. **Infertility, short height, webbed neck and low hairline at lack are symptoms of _____ syndrome.**
A) Turner's
B) Down's
C) Edward's
D) Patau's

78. **The concentration of sodium ions in body fluids is controlled by the hormone:**
A) Renin
B) Aldosterone
C) Angiotensin
D) CPK

79. **A hormone released from posterior pituitary lobe acts to be actively transport water from filtrate is collecting tubules back to kidney is shown as:**
A) Renin
B) Antidiuretic hormone
C) Angiotensin
D) Growth Factor

80. **The removal metabolic waste from the blood is called:**
A) Thermoregulation
B) Osmoregulation
C) Kidney Failure
D) Excretion

81. **Highly toxic nitrogenous excretory product is:**
A) CO_2
B) Uric Acid
C) Urea
D) Ammonia

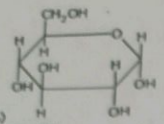
82. **Humans have homeostatic thermostat present in a specified portion of the brain that is:**
A) Lateral ventricle
B) Thalamus
C) Spinal Cord
D) Hypothalamus

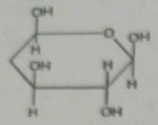
83. **The disease in which death of small number of cells in the basal ganglia leads to inability to select and initiate patterns of movement is known as:**
A) Fever
B) Alzheimer's Disease
C) Epilepsy
D) Parkinson's Disease

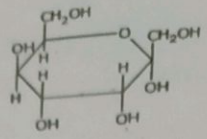
84. **A neurological disorder characterized by the decline in brain function is_____. Its symptoms are similar to those diseases that cause dementia.**
A) Parkinson's Disease
B) Epilepsy
C) Alzheimer's Disease
D) Diabetes

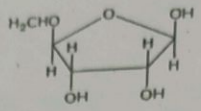
85. **A discharge by brain which causes chaotic activity in motor and sensory areas is:**
A) Meningitis
B) Alzheimer's Disease
C) Epilepsy
D) Parkinson's Disease

86. Which one of the following is the formula of D (α) glucose ?

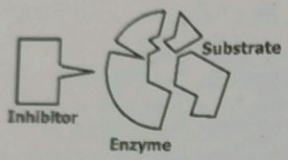
A) 

B) 

C) 

D) 

87. This figure represents _____ inhibitor.



A) Non - competitive
B) Competitive
C) Irreversible
D) Isosteric

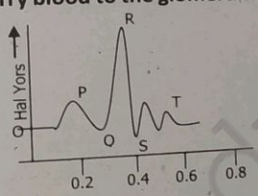
Answers :

1.	A	2.	B	3.	B	4.	B	5.	A	6.	A	7	B	8.	D	9.	D	10.	B
11	B	12	A	13	A	14	B	15	B	16	B	17	B	18	A	19	D	20	A
21	D	22	B	23	C	24	B	25	A	26	A	27	B	28	D	29	A	30	D
31	D	32	B	33	A	34	C	35	B	36	A	37	D	38	C	39	A	40	C
41	A	42	D	43	D	44	C	45	A	46	D	47	A	48	A	49	A	50	C
51	B	52	C	53	B	54	D	55	A	56	D	57	B	58	C	59	C	60	D
61	B	62	C	63	C	64	D	65	D	66	A	67	C	68	B	69	A	70	B
71	C	72	D	73	D	74	A	75	A	76	D	77	A	78	B	79	B	80	D
81	D	82	D	83	D	84	C	85	C										

ENTRANCE TEST – 2017

BIOLOGY

1. **Low partial pressure of oxygen in tissues favours_____of oxyhaemoglobin.**
   A) Dissociation
   B) Formation
   C) Stability
   D) Transformation
2. **Respiratory tubules are termed as bronchioles when they attain the diameter_____or lesser:**
   A) 1.2cm
   B) 1cm
   C) 1mm
   D) 1.2mm
3. **Elastic fibres are absent in the walls of_____:**
   A) Aorta
   B) Arteries
   C) Veins
   D) Capillaries
4. **A type of blood cell that produces heparin is_:**
   A) Basophil
   B) Neutrophil
   C) Eosinophil
   D) Monocyte
5. **Thoracic lymph duct of the lymphatic system opens into_____:**
   A) Superior vena cava
   B) Subclavian Vein
   C) Inferior vena cava
   D) Renal vein
6. **Select the part of nephron which is NOT permeable to water and stops its outflow:**
   A) Glomerulus
   B) Proximal Tubule
   C) Ascending loop
   D) Desceding loop
7. **Vessels which carry blood to the glomerulus are called:**



   A) Efferent arterioles
   B) Renal vein
   C) Vesa recta
   D) Afferent arterioles
8. **In ECG, QRS wave represents:**
   A) Ventricular systole
   B) Atrial systole
   C) Diastole
   D) Recovery systole
9. **When water content in body becomes high, what will happen:**
   A) ADH release will be inhibited
   B) ADH will be released in large amount
   C) Aldosterone will be released
   D) Anterior pituitary will produce ADH
10. **The major factor in producing hypertonic urine is:**
   A) Glomerulus
   B) Influence of aldosterone
   C) ADH influencing on collecting duct
   D) Gradual increase in osmolarity from cortex to inner medula
11. **What is the least selective process during urine formation:**
   A) Reabsorption
   B) Pressure filteration
   C) Secretion
   D) Differential permeability
12. **The nerve impulse which jumps from node to node in myelinated neurons is called as:**
   A) Resting membrane potential
   B) Saltatory nerve impulse
   C) Threshold stimulus
   D) Initial nerve impulse

13. **The CNS is protected by:**
A) Three layers of meninges
B) One layer of moninx
C) 4 layers of meninges
D) 2 layers of meninges

14. **White matter of spinal cord is made up of:**
A) Sensory nerve fibres
B) Myelinated nerve fibres
C) Motor nerve fibres
D) Mixed nerve fibres

15. **There are evidences that high levels of aluminum can lead to the onset of:**
A) Parkinson's disease
B) Alzheimer's disease
C) Lesch-Nyhan syndrome
D) Fragile X-syndrome

16. **_____is the structure in female reproductive system in which fertilization takes place:**
A) Ovaries
B) Uterus
C) Cervix
D) Oviduct

17. **Which of the following directly develops into sperms:**
A) Primary spermatocytes
B) Spermatids
C) Secondary spermatocytes
D) Spermatogonia

18. **FSH stimultes the production of oestrogen hormone which has two targets __and___:**
A) Uterus, posterior pituitary
B) Ovaries, uterus
C) Uterus, anterior pituitary
D) Ovaries, hypothalamus

19. **Select the organelle which is only present in animal cells:**
A) Centrioles
B) R.E.R
C) Microtubules
D) Ribosomes

20. **Syphillis is a sexually transmitted disease and can also damage:**
A) Hair
B) Heart
C) P.N.S
D) Birth canal

21. **Spongy bone is always surrounded by:**
A) Compact bone
B) Cartilage
C) Osteoblast cells
D) Osteoclast cells

22. **Bone matrix is hardened bythe:**
A) Haversian canals
B) Canaliculs
C) Bone marrow tissues
D) Calcium phosphate

23. **The number of bones forming skull in man is:**
A) 8
B) 14
C) 20
D) 22

24. **The spine consists of linear series of :**
A) 33 bones
B) 24 bones
C) 12 bones
D) 7 bones

25. **W.O.F changes occurs when skeletal muscles contract:**
A) I-band shortens only
B) A-band shortens and Z-lines move apart
C) I-band shortens and Z-lines come close to each other
D) Actin filament contracts

26. **The thyroxine hormones of thyroid glands act directly on:**
A) Iodine metabolism
B) Protein metabolism
C) Glucose metabolism
D) Basal metabolic rate

27. **All the hormones released by anterior pituitary are tropic hormones except:**
A) TSH
B) STH
C) ACTH
D) Gonadotrophin hormone

28. **W.O.F is endocrine as well as exocrine:**
A) Liver
B) Adrenals
C) Thyroid
D) Pancreas

29. **Ovulation is suppressed by progestrone via:**

A) Only by inhibition of LH
B) Inhibition of FSH & stimulation of LH
C) Inhibition of LH & stimultion of FSH
D) Inhibition of both FSH & LH

30. **The antibody molecule consists of____polypeptide chains:**
A) Eight
B) Four
C) Six
D) Two

31. **_____cells survive for a few days and secrete a huge no of antibodies in blood, tissue fluids or lymph:**
A) Memory cells
B) B-lymphocytes
C) T-lymphocytes
D) Plasma cells

32. **The intermediate protection from infection of snake bite can be obtained by:**
A) Active Immunity
B) Natural active immunity
C) Passive immunity
D) Vaccination

33. **Chlorophyll molecule contains:**
A) Mg++
B) Ca++
C) K+
D) Na+

34. **The tail of chlorophyll molecule is embedded in:**
A) Membrane of mitochondria
B) Thylakoid membrane
C) Membrane of S.E.R
D) Membrane of R.E.R

35. **Carotenoids absorb light of:**
A) Yellow-orange range
B) Yellow-red range
C) Orange-red range
D) Blue-violet range

36. **Chlorophyll 'a' and chlorophyll 'b' differ in one of the functional groups... Chlorophyll 'a' has:**
A) -CHO
B) -OH
C) -CH3
D) -NH2

37. **Glycerate-3-phosphate in the presence of ATP and reduced NADP from light dependent stage is reduced to:**
A) 3- carbon compound
B) Ribulose bisphosphate
C) 5-carbon compound
D) 6-carbon compound

38. **Calvin cycle occurs in:**
A) Grana of chloroplast
B) Stroma of chloroplast
C) Chlorophyll (Reaction centre)
D) Roots of plants

39. **Restriction enzyme EcoR1 cuts DNA to produce:**
A) Blunt ends
B) Non-palindromic ends
C) Sticky ends
D) Split ends

40. **Restriction endonucleases are produced by:**
A) Fungi
B) Algae
C) Bacteria
D) Viruses

41. **DNA segments of different lengths can be separated by a process of:**
A) Western blotting
B) Northern blotting
C) Autoradiography
D) Gel electrophoresis

42. **The is the 1st heat stable component used in PCR:**
A) Taq-isomerase
B) Taq-helicase
C) Taq-polymerase
D) Taq SSBp

43. **Patients of cystic fibrosis (CF) produse thick mucus because of faulty:**
A) Trans-membrane carrier
B) Cl- ions
C) Na+ ions
D) Mucus membrane

44. **Chemicals used for destroying agricultural competitors are known as:**
A) Antibiotics
B) Pesticides
C) Disinfectants
D) Chemotherpeutic agents

45. **How denitrification does occur in soils:**
A) Bacterial reduction of NO_3^- ions to N2 gas
B) Active uptake of Nitrate ions by plant roots

C) Drainage of manure from fields
D) Leaching of nitrate ions

46. **Process by which unrelated species evolve to functionally resemble each other is called:**
A) Convergent evolution
B) Divergent evolution
C) Co-evolution
D) Parallel evolution

47. **W.O.F shows evidences from evolution through molecular biology:**
A) Development of bronchial arches in verterbrate embryo
B) Distribution of species
C) Comparision of genes and proteins in different species
D) Study of vestigial organs

48. **Large population size, random mating, no mutation and no emigration or immigration are the postulates of:**
A) Hardy-Weinberg theorem
B) Mendel's law of independent assortment
C) Mendel's law of segregation
D) Theory presented by Schleiden and Schwann

49. **Pure breeding lines of pea were taken regarding seed shape — Round and wrinkled and were crossed with no intermediate between parents. All offsprings were found to be round. These results show:**
A) Co-dominance
B) Dominance-recessive relationship
C) Incomplete dominance
D) Over dominance relationship

50. **Base substitution, deletion and insertion are examples of:**
A) Chromosomal aberration
B) Point mutation
C) Aneuploidy
D) Euploidy

51. **The condition in which the heterozygote has a phenotype intermediate between contrasting homozygous parents is called as:**
A) Dominance
B) Incomplete dominance
C) Co-dominance
D) Over- dominance

52. **The interaction between different genes occupying different loci is:**
A) Dominance
B) Co-dominance
C) Pleiotropy
D) Epistasis

53. **Locus stands for:**
A) Position of gene on homologous chromosome
B) Regions of chromosomes
C) Position of an allele within a DNA molecule
D) Close regions of same chromosome

54. **Self fertilization of F-1 dihybrids, following independent assortment of alleles result in:**
A) 3/16 Tall-round ; 3/16 dwarf-wrinkled
B) 9/16 Tall-wrinkled ; 3/16 dwarf-round
C) 9/16 Tall-round ; 3/16 Dwarf-round
D) 3/16 Tall-wrinkled ; 3/16 Dwarf-round

55. **As a result of cross-fertilization of a true breeding pea plant having purple coloured flowers with that of white coloured flowers, the offsprings will have flowers with:**
A) 1/4 purple ;3/4 white
B) 1/4 white ; 3/4 purple
C) All white
D) All purple

56. **The gene for red-green colour blindness is present on:**
A) Y-chromosome
B) X-chromosome
C) Autosome 7
D) Autosome 9

57. **W.O.F structures is present in both plant and animal cells but is absent in prokaryotic cells:**
A) Centrioles
B) Microtubule
C) Plastids
D) Sieve-tubes

58. **Cilia and flagella are absent in:**
A) Viruses
B) Bacteria
C) Higher plants
D) Lower animals

59. **DNA molecule in prokaryotes is:**
A) Single, circular, double stranded molecule not bound by membrane
B) Double, circular molecule
C) Linear double stranded molecule
D) Single, circular, double stranded, membrane bound

60. **Nucleoid is a structure not found in:**
A) Campylobacter
B) Cyanobacteria
C) Spirochete
D) Goblet cells

61. **Cell wall structure of a cell of unknown origin was studied and was found to contain polysaccharide chain linked with short chains of amino acid.. What do u think it can be??**
A) Bacteria
B) Fungi Cell
C) Algae
D) Cortex cells

62. **Ribosomes present in prokaryotes are:**
A) 80S
B) 60S
C) 50S
D) 70S

63. **Functionally mesosomes can be compared with:**
A) Ribosomes
B) Mitochondria
C) Polysomes
D) Golgi bodies

64. **Students were asked to give a guess about a unicellular organism with darkly stained nucleus.. W.O.F can be straight away excluded from the list:**
A) Paramecium
B) Amoeba
C) Plasmodium
D) Lactobacillus

65. **Binary fission is a characteristic cell division NOT found in:**
A) Pseudomonas
B) Campylobacter
C) Euglena
D) E.coli

66. **_____are the specific structures related to monosaccharides:**
A) Glycosidic bond
B) Keto group
C) Maltose
D) Fructose

67. **_____are the major site for storage of glycogen in animal's body:**
A) Muscle and liver
B) Around thighs and belly
C) Around belly and hips
D) Liver and kidneys

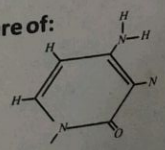
68. **The number of amino acids that have been found to occur in cells and tissues are:**
A) 170
B) 20
C) 25
D) 45

69. **Most proteins are made up of_____type of amino acids:**
A) 20
B) 170
C) 25
D) 200

70. **If in lipids there is an higher proportion of unsaturated fatty acids then it will be:**
A) Oils
B) Waxes
C) Phenols
D) Fats

71. **When X-rays are passed through crystalline DNA, it shows helix making one twist every:**
A) 2nm
B) 3.4nm
C) 34nm
D) 4nm

72. **Following is the structure of:**



A) Uracil
B) Thymine
C) Guanine
D) Cytosine

73. **All enzymes are_____:**

A) Uracil
B) Thymine
C) Guanine
D) Cytosine

74. The reactants on which enzyme works are:
A) Products
B) Metabolites
C) Substrates
D) Catabolites

75. W.O.F comprises of inorganic ions:
A) Coenzymes
B) Activators
C) Prosthetic group
D) Apoenzyme

76. W.O.F is a non-cellular infectious entity:
A) Mycoplasma
B) Escherichia coli
C) Herpes virus
D) Diplococcus

77. The viruses can reproduce:
A) Without invading any cell
B) In bacterial cell
C) By mitosis
D) By meiosis

78. The life cycle in which the phage kills the bacteria is known as:
A) Transduction
B) Temperate phage cycle
C) Lytic cycle
D) Lysogenic phage cycle

79. In W.O.F shapes, gut living symbiont Escherichia coli is found:
A) Round
B) Oval
C) Spiral
D) Rod

80. Chitin, a chemical found in exoskeleton of arthropods is also found in cell wall of:
A) Bacteria
B) Fungi
C) Cyanobacteria
D) Algae

81. Snails are the intermediate hosts in:
A) Fasciola hepatica
B) Taenia solium
C) Schistoma
D) Ancyclosoma duodenale

82. _____is an intestinal parasite of man belonging to phylum nematoda:
A) Taenia solium
B) Wucheronia bancrolti
C) Ascaris lumbricoides
D) Schistoma

83. Food is diverted in the oesophagous by:
A) Glottis
B) Tongue
C) Cheeks
D) Epiglottis

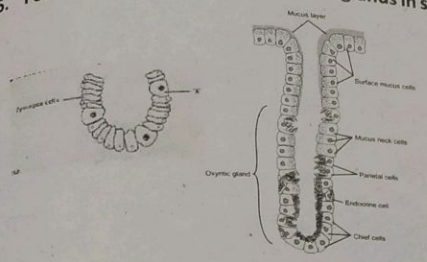
84. Label 'a' in the following diagram:

A) Cardiac sphincter
B) Sinoatrial valve
C) Stomach valve
D) Pyloric sphincter

85. Enzyme pepsin acts on:

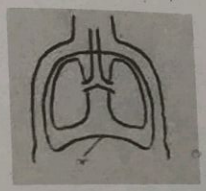
Options	Substrate	Products
A	Protein	Polypeptides
B	Polypeptide	Dipeptides
C	Fats	Fatty acids/ glycerol
D	Protein	Amino Acids

86. Following is the structure of gastric glands in stomach wall where 'x' is:



A) Mucosa
B) Mucus cells
C) Visceral fat cells
D) Oxyntic cells

87. Label the part 'Y' in the following diagram:



A) Pleura
B) Diaphragm
C) Chest cavity
D) Intercoastal muscles

88. W.O.F is a respiratory disorder related to malnutrition:
A) Cancer
B) Asthma
C) Emphysema
D) Tuberculosis

swers :

1.	A	2.	C	3.	C	4.	A	5.	B	6.	C	7	D	8.	A	9.	A	10.	C
11	B	12	B	13	A	14	B	15	B	16	D	17	B	18	C	19	A	20	D
21	A	22	D	23	D	24	A	25	C	26	D	27	B	28	D	29	A	30	B
31	D	32	C	33	A	34	B	35	D	36	C	37	A	38	B	39	C	40	C
41	D	42	C	43	A	44	B	45	A	46	A	47	C	48	A	49	D	50	B
51	D	52	D	53	C	54	D	55	D	56	B	57	B	58	A	59	A	60	D
61	A	62	D	63	B	64	D	65	C	66	B	67	A	68	A	69	C	70	A
71	B	72	D	73	D	74	C	75	B	76	C	77	B	78	C	79	D	80	B
81	A	82	C	83	D	84	D	85	A	86	D	87	B	88	D				

ENTRANCE TEST – 2018

BIOLOGY

1. **Rod-shaped bacteria are known as_____**
   A) Bacilli
   B) Cocci
   C) Spirillia
   D) Spirochete
2. **The enzymes required in Glycolysis are present in:**
   A) Golgi Apparatus
   B) Inner Mitochondrial Membrane
   C) Cell cytoplasm
   D) Matrix of Mitochondria
3. **When a nerve impulse from one node of Ranvier to the next in a myelinated neuron, it is called _____.**
   A) Saltatory conduction
   B) Synapses
   C) Resting potential
   D) Membrane potential
4. **Growth in the larva of young arthropods is restricted by**
   A) Appendages
   B) Exoskeleton
   C) Reduced mitosis
   D) Endoskeleton
5. **Divergent Evolution produces:**
   A) Homologous Organs
   B) Vestigial Organs
   C) Vital Organs
   D) Analogous Organs
6. **Organs Specialized to perform different functions but structurally alike are**
   A) Homologous organs
   B) Autologous organs
   C) Analogous organs
   D) Analogous organs
7. **Synthesis of microtubules increases in**
   A) G1 – phase
   B) S – phase
   C) G2 – phase
   D) M – phase
8. **If lipopolysaccharides did not appear in the wall of bacteria on staining then it will be known as_**
   A) Gram positive
   B) Gram positive & gram negative
   C) Gram negative
   D) Capsule
9. **The first part of the large intestine is**
   A) Caecum
   B) Rectum
   C) Colon
   D) appendix
10. **Site of protein synthesis in cells are**
    A) Smooth Endoplasmic Reticulum
    B) Ribosomes
    C) Nucleolus
    D) Endoplasmic Reticulum
11. **_____ is the exact position of a gene on the chromosome.**
    A) Genotype
    B) Locus
    C) Centromere
    D) Trait
12. **Salivary Amylase begins to digest Starch to shorter polysaccharides and then to**
    A) Sucrose
    B) Glucose
    C) Maltose
    D) Lactose
13. **In viruses, a combined structure formed by core (Nucleic Acid) and capsid is:**
    A) Nucleocapsid
    B) Envelope
    C) Capsomeres
    D) Prion
14. **Which hormone causes the contraction walls of uterus during the process of birth?**
    A) STH
    B) FSH
    C) LTH
    D) Oxytocin
15. **When two or more Alleles do not show complete dominance or both the Alleles are expressing independently in heterozygote condition is called**
    A) Complete dominance
    C) Co dominance

B) Over dominance
D) Incomplete dominance

16. **The thickest chamber of human heart is**
A) Left atrium
B) Right atrium
C) Right ventricle
D) Left ventricle

17. **Gradual break down of the alveolar wall leads to which type of disease in a smoker?**
A) Asthma
B) Bronchitus
C) Coronary heard disease
D) Emphysema

18. **Which of the following holds alveolar wall leads to which type of disease in a smoker?**
A) Asthma
B) Amino group
C) R group
D) Disulphide bond

19. **Lysogenic Viruses are also known as**
A) Bacteriophage
B) Enveloped Phage
C) Virulent Phage
D) Prophage

20. **Conversion of ammonium into nitrates is**
A) Denitrification
B) Nitrification
C) Nitrogen Fixation
D) Ammonification

21. **Which combination is the example of ball and socket joints**
A) Shoulder and knee joints
B) Hip and elbow joints
C) Hip and knee joints
D) Hip and shoulder joints

22. **In nervous system chemical messengers are called_____.**
A) Enzymes
B) Neurotransmitters
C) Chemoreceptores
D) Hormones

23. **Which lipid is totally hydrophobic or insoluble**
A) Terpenoids
B) Phospholipids
C) Waxes
D) Triglycerides

24. **In immunoglobulins / antibodies, Two light chains and two heavy chains are linked to each other by:**
A) Covalent bonds
B) Hydrogen bonds
C) Disulphide bonds
D) tonic bonds

25. **_____ is the site of light independent reaction**
A) Thylakoid space
B) Thylakoid membrane
C) Grana
D) Stroma

26. **Keeping correct balance of ions and water in our body is called as:**
A) Excretion
B) Thermoregulation
C) Osmoregulation
D) Selective reabsorption

27. **NADP, nicotinamide adenine dinucleotide phosphate, is a carrier of:**
A) Hydrogen
B) Phosphate
C) – OH Group
D) O_2 Group

28. **Following group is the example of acoelomates**
A) Platyhelminthes
B) Mollusca
C) Aschelminthes
D) Annelids

29. **Enzyme used by the Bacteria to cut the DNA of the invading Virus for its protection is**
A) Restriction Endonuclease
B) Restriction Ligase
C) DNA polymerase
D) Restriction exonuclease

30. **Ribosomes are made up of _____ and _____.**
A) RNA and proteins
B) RNA and Lipid
C) RNA and carbohydrates
D) Proteins and carbohydrates

31. **In aerobic respiration**
A) Pyruvate is completely oxidized, to form oxygen and water
B) Pyruvate carboxylated to produce citrate
C) Pyruvate is converted to ethanol and carbon dioxide

D) Proteins and carbohydrates

32. **In human female egg is fertilized in**
A) Vagina
B) Uterus
C) Oviduct
D) Ovary

33. **Process ensuring the survival of species over long periods of time, even though individual members of the species die.**
A) Respiration
B) Adaptability
C) Mitosis
D) Reproduction

34. **Single ringed pyrimidines are:**
A) Cytosine, Adenine and Thymine
B) Adenine and Guanine
C) Uracil, Cytosine and Thymine
D) Cytosine, Guanine and Uracil

35. **Tonoplast bounds which organelle**
A) Endoplasmic Reticulum
B) Nucleus
C) Golgi Complex
D) Vacuoles

36. **The temperature that promotes the maximum activity of enzyme is referred as _____**
A) Fixed temperature
B) Optimum temperature
C) Controlled temperature
D) Active temperature

37. **The Hormone which controls the uptake of the Sodium ions in kidney and its maintenance in blood plasma is**
A) Gonadotrophic Hormone
B) Somatotrophic Hormone
C) Thyroxin hormone
D) Aldosterone Hormone

38. **By PCR we means**
A) Polymerase cross reaction
B) Polymerase chain reaction
C) Polymerase copy reaction
D) Polymerase chronic reaction

39. **Number of salivary glands founds in human oral cavity.**
A) 3
B) 4
C) 6
D) 2

40. **The actual or preserved remains of the organisms that lived in the ancient past are called**
A) Fossils
B) Impression
C) Ancient prints
D) Ancient cast

41. **How many sodium ions are pumped out in response to two potassium ions transported into the membrane?**
A) 4
B) 2
C) 1
D) 3

42. **The region of the chromosome or, more specifically, a length of the DNA molecule, which has a particular function is called _____**
A) Locus
B) Gene
C) Allele
D) Kinetochore

43. **The enzymes required for Krebs cycle are found in _____.**
A) Lysosomes
B) Matrix
C) Cytoplasm
D) F_1 particles

44. **DNA made by joining pieces from two or more different sources**
A) Mutated DNA
B) Restriction endonuclease
C) Probes
D) Recombinant DNA

45. **At the last step of Glycolysis which of the following compound is formed**
A) Fructose phosphate
B) Ethyl Alcohal
C) Pyruvic Acid / Pyruvate
D) Lactic acid

46. **A non-protein part essential for proper and essential functioning of enzyme is called**
A) Extra factor
B) Additional factor
C) Efficient co factor
D) Co factor

47. **Lipid synthesis or lipid metabolism is the function of:**

A) Smooth Endoplasmic Reticulum
B) Rough Endoplasmic Reticulum
C) Mitochondria
D) Golgi complex

48. **Which of the following statement is correct about the respiratory pigments**
A) Albumin Globulin and Globin proteins are present in respiratory pigments
B) Myoglobin and Hemoglobin has higher affinity for nitrogen
C) Myoglobin has more affinity for oxygen as compared to haemoglobin
D) Cyanide and Haemoglobin has low affinity for oxygen

49. **Which statement is correct about mitochondria and chloroplast**
A) chloroplast and mitochondria cannot live independently
B) 70 S ribosome is attached with the inner membrane of mitochondria and chloroplast.
C) Chloroplast and mitochondria are single membrane structures
D) Number of mitochondria and chloroplast are same in all cells

50. **Which one of the following cells does not have nucleus**
A) Eosinophils
B) Platelets
C) Basophils
D) Neutrophils

51. **Which one of the following is Multiple allelic character?**
A) Length of stem in pea plant
B) Shape of seed in pea plant
C) Blood group of the human being
D) Colour of flower in pea plant

52. **Cell mediated immune response is given by:**
A) Neutrophils
B) T lymphocytes
C) Macrophages
D) B lymphocytes

53. **Which of the following is Unsaturated "Fatty Acid"**
A) Butyric Acid
B) Stearic Acid
C) Oleic Acid
D) Palmitic Acid

54. **Yeasts, the unicellular fungi belongs mostly to the group:**
A) Basidiomycota
B) Deuteromycota
C) Ascomycota
D) Zygomycota

55. **Which statement is correct about atrial systole**
A) Atria relax and ventricles contract
B) Atria contract and ventricle also contract
C) Atria and ventricles are relaxed
D) Ventricles remain relax while atria contract

56. **Chitin which makes the Exoskeleton in insects is further hardened by**
A) Protein and Calcium Carbonate
B) Protein and Potassium Carbonate
C) Protein and Sodium Carbonate
D) Protein and sodium Bicarbonate

57. **Antivenom given after a snake bite venom is an example of**
A) Artificial active immunity
B) Natural active immunity
C) Artificial passive immunity
D) Natural passive immunity

58. **The ability to distinguish between two separate points/objects is**
A) Fractionation
B) Magnification
C) Centrifugation
D) Resolution

59. **Crossing over takes place during _____ of meiosis.**
A) Prophase I
B) Telophase I
C) Anaphase I
D) Metaphase I

60. **Glycosidic bond is formed by the:**
A) Removal of Water
B) Addition of Oxygen
C) Removal of Oxygen
D) Addition of Water

61. **The term "Loss of appetite" refers to disease:**
A) Anorexia nervous
B) Obesity
C) Bulimic nervous
D) Botulism

62. **These structures are involved in the breakdown of old organelles.**
A) Leucoplasts
B) Lysosomes
C) Glyoxysomes
D) Peroxisome

63. **During breading air from pharynx enters to**
A) Alveoli
B) Esophagus
C) Bronchi
D) Trachea

64. **Blood solute potential is controlled by following hormone**
A) Vasopressin
B) Thyroxin
C) Epinephrine
D) Androgens

65. **When filtration is completed the waste products through distal tubule of Nephron empties to**
A) Proximal tubules
B) Efferent Arterioles
C) Peritubular capillaries
D) Collecting Tubules

66. **The number and sequence of amino acids along a polypeptide chain is called _____structure of a protein.**
A) Secondary
B) Quaternary
C) Primary
D) Tertiary

67. **_____ hormone is released from posterior lobe of pituitary gland.**
A) Thyroid stimulating hormone
B) Adrenaline
C) FSH
D) Antidiuretic hormone

68. **When we extract Carotenoids from its source we see that it is**
A) Yellow to orange red in color
B) Yellow green in color
C) Blue green in color
D) Violet in color

69. **An area previously supporting life is made barren, the subsequent recolonization is called _____**
A) Pioneer succession
B) Primary succession
C) Climax community
D) Secondary succession

70. **Parathormone hormone production is controlled by the blood**
A) Sugar level
B) Ca level
C) Na level
D) Mg level

71. **Which hormone is released in female in response to FSH from pituitary gland?**
A) Oxytocin
B) ADH
C) Oestrogen
D) Progesterone

72. **Skull, vertebral column, ribs and sternum forms:**
A) Hydrostatic skeleton
B) Axial skeleton
C) Exoskeleton
D) Appendicular skeleton

73. **Coccyx vertebrae are located in**
A) Pelvic region
B) Thoracic region
C) Cervical region
D) Lumber region

74. **The cisternae breaks up into vesicles from _____, _____ of Golgi complex.**
A) Convex, forming face
B) Concave, forming face
C) Convex, maturing face
D) Concave, maturing face

75. **The low levels of surfactant produced by alveolar epithelium causes:**
A) Emphysema
B) Bronchitis
C) Epithelium distress syndrome
D) Asthma

76. **There are _____ number of linkage groups in human**
A) 22
B) 23
C) 46
D) 80

77. **Chemical nature of primer used in PCR process is _____**
A) Protein
B) Chemical
C) RNA
D) DNA

78. **Urea is the detoxification of**
A) Carbon dioxide
B) Ammonia
C) Creatinine
D) Amino acids

79. **Deficiency of enzyme _____ causes combined immunodeficiency syndrome**
A) Adenosine transaminase
C) Adenosine deaminize

B) Adenosine polymerase
D) Adenosine transcriptase

80. **Taste buds on the tongue are example of:**
A) Thermoreceptors
B) Photoreceptors
C) Pressure reception
D) Chemoreception

81. **In cross section each Centriole consist of nine (each in triplets) of**
A) Microtubules
B) Microfilament
C) Microvilli
D) Intermediate filaments

82. **Which one of the following act as a PACEMAKER in Heart**
A) Atrio ventricular node
B) Atrio ventricular bundles of fibers
C) Sino atrial node
D) Bundle of His

83. **Scapula is a**
A) Shoulder bane
B) Skull bone
C) Tail bone
D) Hip bone

84. **Chance of a cross over between two loci is directly proportional to their**
A) Length
B) Distance
C) Width
D) Thickness

85. **The capillaries of glomerulus rejoin to form an _____**
A) Collecting duct
B) Peritubular capillaries
C) Afferent arteriole
D) Efferent arteriole

86. **If molecule can bind to another site of the enzyme rather than the true active site, it is referred as_**
A) Non – competitive inhibitors
B) Allosteric inhibition
C) Competitive inhibitors
D) Irreversible inhibition

87. **Which of the following hormone acts on the uterus wall for thickening?**
A) Zone pellucida
B) Progesterone
C) Oxytocin
D) Follicle stimulating hormone

88. **A complete turn of the double helix of DNA comprises of:**
A) 3. 4 nm
B) 3, 4 Angstrom
C) 34 nm
D) 34 micrometer

Answers :

1.	A	2.	C	3.	A	4.	B	5.	A	6.	A	7	C	8.	A	9.	A	10.	B
11	B	12	C	13	A	14	D	15	C	16	D	17	D	18	A	19	D	20	B
21	D	22	B	23	D	24	C	25	D	26	C	27	A	28	A	29	A	30	A
31	C	32	C	33	D	34	C	35	D	36	B	37	D	38	B	39	C	40	A
41	D	42	B	43	B	44	D	45	C	46	D	47	A	48	C	49	A	50	B
51	C	52		53	C	54	C	55	D	56	A	57	C	58	D	59	A	60	A
61	A	62	B	63	D	64	A	65	D	66	C	67	D	68	A	69	D	70	B
71	C	72	B	73	A	74	D	75	C	76	B	77	D	78	B	79	C	80	D
81	A	82	C	83	A	84	B	85	D	86	A	87	B	88	A				

ENTRANCE TEST – 2019
BIOLOGY

1. **In chemiosmosis the proton (H^+) pumps moves from _____.**
   A) Stroma to Lumen
   B) Stroma to cytoplasm
   C) Lumen to Stroma
   D) Cytoplasm to Stroma
2. **Microtubule subunits (for spindle fibers) are synthesized in _____ phase.**
   A) G_2
   B) M
   C) S
   D) G_1
3. **If stimulation is above _____, impulses travel to the brain along the sensory neuron.**
   A) Action Potential
   B) Threshold
   C) Resting Potential
   D) Recovery Period
4. **Substances responsible for increasing the set point of the hypothalamus are called.**
   A) Pepsin
   B) Pyrogens
   C) Prions
   D) Androgens
5. **During inspiration the space inside the chest cavity is increased due to:**
   A) Increased pressure
   B) The relaxation of the muscles of the diaphragm
   C) Relaxation of the external intercostal muscles
   D) The contraction of the muscles of the diaphragm
6. **Which of the following hormone stimulates the ovulation from the follicle into oviduct**
   A) Luteinizing hormone
   B) Follicle stimulating hormone
   C) Estrogen
   D) Progesterone
7. **The covalent bond or bridge between two monosaccharides to form a disaccharide is called a:**
   A) Carboxyl bond
   B) hydroxyl bond
   C) Hydrogen bond
   D) Glycosidic bond
8. **Site of protein synthesis is:**
   A) Ribosomes
   B) Lysosomes
   C) Golgi body
   D) Cisternae
9. **Water and Minerals move down their concentration gradient through plasmodesmata, to cells of cortex, endodermis, pericycle and then to sap in the xylem cells, This is also known as the**
   A) Symplastic pathway
   B) Mineral absorption Pathway
   C) Vacuolar pathway
   D) Apoplastic pathway
10. **Xerophytes have small thick leaves to:**
    A) Help them float on water
    B) Help them survive in salty environment
    C) Limit water loss by reducing the surface area.
    D) Limit water loss by increasing the surface area
11. **Among following which cellular organelle contains circular DNA similar to those found**
    A) Ribosome
    B) Lysosome
    C) Chloroplast
    D) Nucleus
12. **A person was married to his cousin and both are heterozygous for sickle cell anemia. Among their four kids, what will be proportion of affected homozygotes?**
    A) 50%
    B) 25%
    C) 75%
    D) 100%
13. **The route of urine excretion from kidney to outside of body is:**
    A) Kidney – ureter – urinary bladder – urethra
    B) Urinary bladder – Kidney – ureter – urethra
    C) Kidney – ureter – urethra – urinary bladder
    D) Kidney – urethra – urinary bladder – ureter
14. **The phase of mitosis in which sister chromatids move towards opposite poles:**

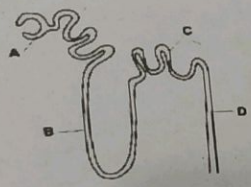
A) Prophase
B) Anaphase
C) Telophase
D) Metaphase

15. **The Plasmid pBR322 has antibiotic resistance genes for:**
A) Tetracycline and Doxycycline
B) Streptomycin
C) Doxycycline and Ampicillin
D) Ampicillin and Tetracycline

16. **The nitrogen containing bases in nucleotide are of two types; Purines and Pyrimidines; The purines bases are:**
A) Guanine and Cytosine
B) Adenine, Guanine and Cytosine
C) Adenine and Guanine
D) Adenine and thymine

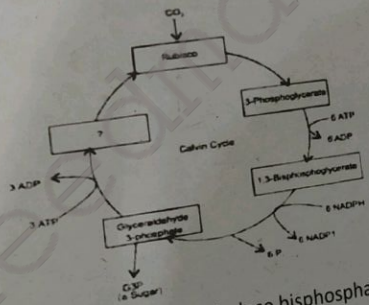
17. **The type of energy reduced by the enzymes for biological reaction to occur is called**
A) Light Energy
B) Activation energy
C) Active energy
D) heat energy

18. **Given below is the diagram of nephron without vascular supply.**



What is name of Part C?
A) Collecting tubule
B) Proximal tubule
C) Distal tubule
D) Loope of Henle

19. **The following flowchart depicts the steps of the Calvin Cycle. Which option according to you fits in as the correct answer of the missing step?**



A) Hydrogenate
B) Oxaloacetate
C) Ribulose bisphosphate
D) Pyruvate

20. **DNA polymerase enzyme for PCR is isolated from bacteria thermus aquaticus because:**
A) It can withstand high denaturation temperature.
B) It can withstand low denaturation temperature.
C) It can work at high speed
D) It can be used again and again.

21. **The function of calcium ions in muscle contraction is to:**
A) Bind to troponin molecule and cause them to move
B) Aid in the transmission of nerve impulse
C) Polarize visible light.

D) Bind to tropomyosin molecule and cause them to form cross bridges

22. **What is common in both Competitive and Non – Competitive Inhibition?**
A) Irreversible Inhibition
B) Feedback Inhibition
C) Reversible inhibition
D) Non – Reversible inhibition

23. **Inside ovary, primary oocyte divides through first meiotic division forming two haploid cells, secondary oocyte and:**
A) Polar body
B) Oogonium
C) Follicle cell
D) Ovum

24. **Homozygous means:**
A) Having two identical alleles of a gene.
B) Having two identical genes
C) Alleles in an organism
D) Two different alleles of a gene.

25. **Which hormonal pair would maintain the endometrium and make it receptive for implantation of embryo?**
A) Luteinizing Hormone and Progesterone
B) Estrogen and Follicle stimulating hormone
C) Luteinizing Hormone and Follicle Stimulating Hormone
D) Estrogen and Progesterone.

26. **Starch is present in tubers, fruits and grains but cells, instead animals have a substance stored in liver and muscles known as:**
A) Glucose
B) Glycogen
C) Galactose
D) Glucagon

27. **Now – a – days every new born gets regular shots of vaccine for polio. It contains _____ for polio to make a child immune against this disease.**
A) Antisera
B) Antibodies
C) Antibiotics
D) Antigens

28. **Which of the following blood vessels contain semilunar valves**
A) Arteries
B) Veins
C) Arterioles
D) Capillaries

29. **The main neurotransmitter for synapses is _____which lie outside the central nervous system.**
A) Choline
B) Acetylcholine
C) Actin
D) Myosin

30. **The thick filaments in a myofibril of muscles are made of _____.**
A) Hemoglobin
B) Myoglobin
C) Actin
D) Myosin

31. **The prokaryotes possess small ribosome of size:**
A) 40S
B) 70S
C) 65S
D) 60S

32. **The structure present in a eukaryotic cell but absent in prokaryotic cells is**
A) Nuclease
B) DNA
C) Ribosomes
D) Cell surface membrane

33. **The process in which a complimentary copy of the code from a gene is produced by RNA polymerase in the nucleus:**
A) Proof reading
B) DNA Replication
C) Transcription
D) Translation

34. **Sara is a chemistry student who is carrying out an experiment between an alcohol and acetic acid in the laboratory. The product formed at the experiment will be:**
A) Glucose and oxygen
B) Glycogen and water molecule
C) An ester and water molecule
D) Glycerol and sulfuric acid

35. **In genetics, the term locus refers to the _____of the gene on the chromosome.**

A) Frequency
B) Copy
C) Position
D) Inversion

36. If $15\mu m$ size object is observed under light microscope using 5X eyepieces and 10X objective, its magnified image size will be:
A) $250\mu m$
B) $50\mu m$
C) $750\mu m$
D) $500\mu m$

37. Change in frequency of alleles that occurs by chance is called as:
A) Natural selection
B) Migration
C) Mutation
D) Genetic drift

38. Which enzyme is administered to the patients of Severe combined Immunodeficiency Disease (SCID)?
A) Pancreatic Enzyme
B) Adenosine Deaminase (ADA)
C) β - galactosidase
D) β - lactamase

39. The finger like infoldings which are formed by inner membrane of mitochondria are
A) Matrix
B) Porin
C) Cristae
D) Ribosomes

40. The main nitrogenous excretory product of humans is:
A) Uric acid
B) Ammonia
C) Urea
D) Ammonium

41. Smooth endoplasmic reticulum is responsible for the metabolism of:
A) Carbohydrates
B) Proteins
C) Nucleic acids
D) Lipids

42. Acetylecholine and Noradrenaline are two types of _____ used in our nervous system.
A) Hormones
B) Channel and carrier proteins in the cell membrane of a Neuron.
C) Enzymes
D) Neurotransmitters

43. The reflex action is the phenomena which only involves:
A) Brain, receptors, spinal cord
B) Receptors, effectors and spinal cord
C) Receptors, neurons, brain
D) Receptors and effectors

44. In which situation, Genes are not assorted independently during Meiosis in a chromosome?
A) When genes are not linked and their loci are far apart.
B) When there are too many genes on a chromosome.
C) When some genes have mutated on the chromosome.
D) When genes are linked and their loci are close to each other.

45. A person got an infection, he became ill but then he survived. What do you think which type of immunity he would have developed?
A) Naturally induced active immunity
B) Artificially induced active immunity
C) Active immunity
D) Passive immunity

46. During spermatogenesis, the _____, which are haploid cells eventually mature into spermatozoa/mature sperms:
A) Secondary spermatocytes
B) Primary spermatocytes
C) Spermatogonia
D) Spermatids

47. Transgenic mice have been used to produce:
A) Protein rich milk
B) A growth hormone
C) Protein rich meat
D) Extra hair

48. According to the theory of natural selection, organisms produce:

A) More offspring than supported
B) Less offspring than supported
C) Offspring according to the resources available
D) Offspring to create resources

49. **In glycine R is _____.**
A) Fatty acid
B) Ethane
C) Hydrogen
D) Methane

50. **Glycolysis takes place in the _____ of cell.**
A) Golgi complex
B) Nucleus
C) Cytoplasm
D) Mitochondria

51. **Lipids contain double amount of energy as compared to the same amount of carbohydrates due to the presence of:**
A) Lower proportion of C – H bonds
B) Higher proportion of C – H bonds
C) Higher proportion of C – O bonds
D) Higher proportion of Oxygen

52. **If water has high latent heat of vaporization, how this property of water could be helpful to plants and animals?**
A) With the release of large amount of water vapours, a small amount of heat loss can take place.
B) No cooling effect with the release of even large amount of water vapours.
C) It will keep their temperature very high.
D) With the release of small amount of water vapours, a great amount heat loss can take place.

53. **How many molecules of ATP would be utilized for phosphorylation of one glucose molecule during glycolysis?**
A) One
B) Four
C) Two
D) Three

54. **Among followings, _____ enzyme is naturally found in human immune deficiency virus (HIV).**
A) DNA polymerase
B) RNA polymerase
C) Reverse transcriptase
D) Ligase

55. **The structure of a fibrous protein comprises of polypeptide chains in the form of:**
A) Cluster
B) Flat uncoiled chains
C) Spherical or curled up ball
D) Long strands or fibrils

56. **Which is an example of a Disaccharide:**
A) Lactose
B) Glycogen
C) Starch
D) Fructose

57. **Which one is an example of a Nucleotide?**
A) Adenosine
B) ATP
C) Guanine
D) NAD

58. **Which of the following photosystem is involved in cyclic photophosphorylation?**
A) PS I and PS II
B) PS II
C) PS III
D) PS I

59. **Which cell organelle is responsible for cell secretion?**
A) Chloroplast
B) Golgi body
C) Ribosome
D) Mitochondrion

60. **Change in frequency of alleles that occurs by chance is called as:**
A) Genetic drift
B) Mutation
C) Migration
D) natural selection

61. **Thin filaments of muscles contain _____ chains of actin molecules.**
A) Two
B) One
C) Three
D) Four

62. **Complementary DNA molecule is**

A) DNA from mRNA
B) An artificial DNA
C) Single stranded DNA
D) A small segment of chromosomal DNA

63. **Meselson and Stahl transferred few bacteria grown in N^{15} medium to N^{14} medium for replicating their DNA. What would be the result after two rounds of replication?**
A) 100% heavy duplex
B) 100% hybrid duplex
C) 50% hybrid duplex and 50% heavy duplex
D) 50% hybrid duplex and 50% light duplex

64. **In an action potential, the permeability of sodium ions in the neurons increases due to:**
A) Repolarization
B) Sodium ions forming an ionic bonding
C) The opening sodium channels / gates
D) The action of the acetylcholinesterase anzyme

65. **The photosynthetic pigments of plants are arranged as clusters in thylakoid membranes. The reaction centers of these clusters consist of _____ molecules**
A) Chlorophyll
B) ATP
C) Carotenoids
D) Glucose

66. **Most proteins are made up of:**
A) 10 types of Amino acids
B) 20 types of Amino acids
C) 170 types of Amino acids
D) 16 types of Amino acids

67. **If a carrier haemophilic female (X^HX^h) is married to a haemophilic male (X^hY). What will be the ratio of presence of haemophilla in the children. Select best answer from given condition.**

$$X^H X^h \ x \ X^h Y$$

A) 100% all females and males will be haemophilic
B) Females have 50% chances of getting haemophillia and males will be 100% haemophilic
C) Carrier female 25%, haemophilic female 25%, 25% normal male and 25% haemophillic male.
D) Females and males both have 50% chances of getting haemophillia

68. **A disease caused by gradual breakdown of the thin walls of alveoli is_____.**
A) Tuberculosis
B) Asthma
C) Emphysema
D) Bronchitis

69. **If sequence in DNA is CCCTAGAG, then what would be the sequence in messenger RNA after transcription?**
A) GGGAUCUC
B) GGGATCTC
C) GGAAUCUC
D) GGGGTCTC

70. **The major function of Basophils is to:**
A) Destroy small particles by phagocytosis
B) Release heparin to prevent blood clotting
C) Transport oxygen
D) Inactivate inflammation producing substances

71. **In plants, which sugar is transported from source to sink through sieve tubes?**
A) Glucose
B) Sucrose
C) Fructose
D) Starch

72. **Four plants are present in different environmental conditions. Plant A is present in warm climate with continuous rainfall, plant B is present in a cool forest, plant C is present in warm climate with little breeze while plant D is present in warm climate with high wind speed. Which one of the above plants will have highest rate of transpiration?**
A) Plant B
B) Plant D
C) Plant A
D) Plant C

73. **Capsid, the protective coat of a virus is made up of _____ subunits known as capsomeres.**
A) DNA
B) RNA
C) Protein
D) Lipid

74. **Taxonomy includes the arrangement of organisms into different taxa. Which of the following represents the correct hierarchy of various taxa of classification?**
A) Species, genus, family, order, class, phylum
B) Order, family, class, phylum, kingdom
C) Species, genus, family, class, order, phylum
D) Species, genus, order, family, class phylum

75. **Passive processes for the movement of molecules across cell surface membrane are:**
A) Osmosis and phagocytosis
B) Pinocytosis and facilitated diffusion
C) Facilitated diffusion and osmosis
D) Diffusion and exocytosis

76. **During the G2 phase:**
A) Chromosome number is duplicated
B) The chromosomes are left with only one chromatid
C) Energy is stored for Chromosome movement and mitotic specific proteins (Tubulin) are produced
D) Specific enzymes are synthesized and DNA base units are accumulated

77. **A student of chemical engineering mistakenly engulfed the toxic compound "A" Which was a potent inhibitor of certain enzyme. He was immediately brought to hospital where Dr. injected intravenously substrate "B" to minimize the toxic effect of compound A. His life was saved from serious damages. The treatment method shows that compound A was a _____ inhibitor.**
A) Non – competitive reversible
B) Irreversible
C) Temperature sensitive
D) Competitive reversible

78. **Sequence of amino acids in a polypeptide chain of protein molecule corresponds to the sequence of nucleotides on mRNA for that protein. If reading frame of mRNA for a human protein is 993 nucleotide including a stop codon at the end, how many amino acids would be incorporated in the polypeptide chain?**
A) 93
B) 330
C) 331
D) 993

79. **Blood group AB is an example of _____.**
A) Complete dominance
B) Recessive alleles
C) Co – dominance
D) Incomplete dominance

80. **As a result of replication, parental DNA would become completely dispersed and that each strand of all the daughter molecules would be a mixture of old and new DNA. This is called as.**
A) Dispersive idea
B) Conservative idea
C) Disruptive idea
D) Semi – conservative idea

Answers:

1.	A	2.	A	3.	B	4.	B	5.	D	6.	A	7	D	8.	A	9.	A	10.	C
11	C	12		13	A	14	B	15	D	16	C	17	B	18	C	19	C	20	A
21	A	22	C	23	A	24	A	25	A	26	B	27	D	28	B	29	B	30	D
31	B	32	A	33	C	34	C	35	C	36	C	37	D	38	B	39	C	40	C
41	D	42	D	43	B	44	D	45	A	46	D	47	B	48	A	49	C	50	C
51	B	52	D	53	C	54	C	55	D	56	A	57	B	58	D	59	B	60	A
61	A	62	A	63	D	64	C	65	A	66	B	67	D	68	C	69	A	70	B
71	B	72	B	73	C	74	A	75	C	76	C	77	D	78	B	79	C	80	D

STARS
ENTRY TEST SERIES

STARS has a separate department for the publications of its books. R&D Department stationed at STARS Academy, Johar Town, Lahore comes to take up this responsibility with grace and grandeur. Grace comes with hardwork, competence, technique, focus and guidance. A good book requires time, patience, wision, study and the knack so as to provide the students best possible material in easy, comprehensive and structured form. For that, a team of prolific writers keep eorking on the books down through the year keeping a keen eye over past papers of different Entrance Test.

STARS PUBLICATIONS has thus far produced 11 ENTRY TEST BOOKS which are in the market and have earned considerable attention and repute due to their compact and up-to-date forms. STARS Team of Books Publications believes that these Entry Test Books will assist you all through the ways to bring you meet your desires to be doctors, engineers and IT experts.

Pakistan's Fastest Growing Entry Test
Preparation Network

Regional Office Multan
Peer Khursheed Colony Road.
0312-2526777

Regional Office Gujranwala
Main Market, Wapda Town Gujranwala
055-4283322, 0301-4283322

Regional Office Faisalabad
67-B Badala colony Satiyana
Road Fasialabad,0321-6680072

HEAD OFFICE
590-Q Main Boulevard Johar Town Lhr.
0321-9432186, 0321-9432177, 0321-4693044
www.stars.edu.pk

GROUP CORPORATE OFFICE
1-Riwaz Garden Lower Mall Lhr.
0335-9432187, 042-37171391-92
facebook.com/StarsAcademyLahore